SECTION 23 09 33 - AUTOMATIC TEMPERATURE CONTROL

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 23 05 00 for requirements which are applicable to this section.
B. Refer to International Mechanical Code.
C. Refer to National Electrical Code.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to install a complete, functioning, Automatic Temperature Control (ATC) system.
B. Power wiring will be provided under the Electrical portion of the work.
C. Control wiring shall be furnished under this portion of the work. Control wiring is line voltage or low voltage if it performs as control wiring. Power for operation of valves and dampers is considered control wiring.
D. ATC contractor to arrange for power for control equipment with electrical contractor. Allow for compensation to the electrical contractor to install a power source which may be required.
E. The mechanical contractor shall be responsible for the complete coordination of all parts of the ATC system whether they be part of packaged control systems within units or built up systems by ATC providers. It is the intent that all systems and subsystems to be coordinated and to be provided to produce the following sequences described in this specification.
F. All control wiring shall be CAT 6 plenum rated. All control wiring shall run concealed in finished spaces. Control wiring to be in conduit in exposed interior unfinished areas and where subject to damage. All exterior exposed control wiring to be in conduit and weather protected. Conduit to be (EMT, galvanized steel). No pvc piping is permitted in plenums.
G. Exposed control wiring in interior finished spaces;
    1. Control wiring to run in Wiremold V500 series. (steel raceway, ¾") and associated fittings.
    2. Finish to be selected by architect.
    3. Contractor to coordinate all final Wiremold run locations and layout with architect/engineer for approval prior to ordering and rough-in.
H. ATC contractor to be present at equipment/system start-up and verify that all wiring and components are installed correctly and the equipment/system sequence of operation is operating as designed. ATC contractor to perform final calibrations of all devices and equipment. ATC contractor to make all the required corrections if the equipment/system does not operate correctly.
I. ATC contractor to coordinate with the test, balancing, and adjusting (TBA) contractor prior to performing equipment/systems tests that all air and hydronic systems have been tested and balanced.

1.03 SUBMITTALS

A. Submit shop drawings of all components.
B. Submit manufacturers' data sheets of valve Cv performance.
C. Submit design data and sequence of operations descriptions for all systems.
D. Submit wiring diagrams of electrical or electronic control systems.
E. At the completion of the project, submit final "as-built" drawings/CAD disk, all associated

component/equipment cut-sheets/submittals, wiring diagrams, and final/actual sequence of operations descriptions of each system. Include ATC emergency contact information.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
B. Work shall be performed by skilled tradesmen normally engaged in the control systems trade.

PART 2 - PRODUCTS

2.01 CONTROL DEVICES - GENERAL

A. All control devices and products used in the control system shall be first-line products, manufactured for the application as used.
B. All thermostats shall have guards. Thermostat guards shall be plastic or metal covers to prevent tampering with the instrument. Provide substantial, locked, opaque cover, hinged to a base which is secured to the wall, not to the thermostat base.
C. Control valves for fluids shall be two-position (On-Off), modulating two-position, three-way, or modulating three-way (mixing or diverter), as required for the application. Modulating valves shall be selected with the proper flow characteristics to allow control of the flow over as wide a range as is possible with a reasonable maximum pressure drop (7 ft.) of water unless noted otherwise.

2.02 ECONOMIZER

A. HVAC units shall be provided with economizer controls where indicated on the drawings or elsewhere in these specifications or on any system 4 tons or over. Enthalpy selection system shall consist of one enthalpy transmitter in the outside air, one enthalpy transmitter in the return air, and a relay to select the lower of the two enthalpies. In operation, the signal from the two enthalpy transmitters shall be compared by the differential switching relay so that when the outside air enthalpy is lower than the return air enthalpy, the temperature control system shall modulate the outside, return, and relief dampers to supply up to 100% outside air for "free cooling". When the outside air enthalpy is higher than the return air, the system shall position to minimum outside air. The use of separate temperature and humidity transmitters to arrive at enthalpy is not acceptable. Outside air transmitter shall not be damaged by operation during fog conditions.
B. The economizer module shall be ASHRAE 90.1 compliant (latest version).
C. The module shall have a local display screen for diagnostics at the unit.
D. On projects with building automation systems the economizer shall have a BACNET output and shall be interconnected to the building automation system.
E. The module shall have fault detection diagnostics.
F. Manufacturer: Belimo Zip Economizer series. Equal by Honeywell.

2.03 CONTROL DEVICES - ELECTRICAL

A. All electrical wiring for the control system shall be as specified in this section and the Electrical Section of the Specifications and as required by local codes. The wiring shall be by this contractor.
B. Electric thermostats shall be low-voltage, modulating type to control modulating devices, or low- or line-voltage type with heat anticipator for two-position controls. Provide locking covers (clear plastic, hinged type).
C. Where noted on the equipment schedules, thermostats to be 24hr./7 day programmable type, auto

changeover type, +/-3 degree adjustment capability (when integrated with building automation system), WIFI capability. Manufacturer: Honeywell. Provide locking cover (clear plastic, hinged type).

2.04 ACCEPTABLE MANUFACTURERS

A. Control equipment shall be manufactured by a company regularly engaged in production of this type of equipment, as shown on the drawings, or equivalent equipment by Honeywell, Johnson Controls, Alerton, Schneider Electric, Delta, or prior approved equals.

2.05 DAMPER AND VALVE ACTUATORS

A. All damper actuators (motors) installed in conjunction with an Air Handler/HVAC unit must be of the spring return, 2 position, occupied/unoccupied type, or modulating where an economizer cycle is required.
B. Combustion air damper actuators shall be of the 2 position, spring return type.

2.06 RELAYS AND SIGNAL TRANSMITTERS

A. All necessary relays, contacts, and interface devices shall be furnished to make the system a full and operable system.

2.07 CONTROL VALVES

A. Hot water control valves shall be of the two-way or three-way, type as indicated with modulating plug, and spring return. Three-point floating type modulation, 0-10vdc or 4-20madc are acceptable. All heating valves shall fail to the open position upon a loss of power.
B. Modulating valves shall be selected with the proper flow characteristics to allow control of the flow over as wide a range as is possible with a reasonable maximum pressure drop (7 ft) of water unless noted otherwise.
C. Valves are to be manufactured by Honeywell, Johnson Controls, Powers, Barber Colman or approved equal.

2.08 DUCT SMOKE DETECTORS

A. Duct smoke detectors shall be of the photo-electronic type with sampling tube of ample length to traverse the entire width of the duct. Duct smoke detectors shall be manufactured by the control companies, the fire alarm companies, B.R.K. Electronics or approved equal. All HVAC units of 2000 CFM or more shall have duct smoke detectors in both the supply and return air streams. A single duct smoke detection in the return air stream shall be provided only when acceptable to the local authority having jurisdiction.
B. Duct smoke detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
C. Units of 15,000 CFM or more shall have two detectors. (supply and return air)
D. Furnish and install where indicated on the drawings or required elsewhere in the specifications air duct smoke detectors. They shall integrate photoelectric, ionization and heat sensing technologies for optimum detection accuracy and to prevent unwanted alarms. Auxiliary contacts shall be provided to shut down the air handling unit fan. The detector shall output to a remote alarm indicator.
E. Duct smoke detectors to be furnished by the electrical contractor.
F. Duct smoke detectors shall be installed by the mechanical contractor.
G. Interconnection between the duct smoke detectors and fire alarm system shall be performed by the electrical contractor/fire alarm contractor.

H. Control's integration to shut down the HVAC equipment in alarm shall be performed by the mechanical contractor/ATC contractor.

2.09 FREEZESTATS

A. The freezestat shall be of the vapor pressure type with a 20 foot minimum element. Element shall respond to the lowest temperature sensed by any one foot section.
B. The freezestat shall be manual reset. Provide reset button and red indicator light. Location to be coordinated with architect.
C. All coils (heating hot water, chilled water, condenser water/water source) with outside air and hot water in ducts or units shall have freezestats.

2.10 MOTOR OPERATED DAMPERS

A. The motor operated dampers shall be of the parallel blade type for all 2-position applications such as the combustion air dampers and of the opposed blade type for all modulating applications including the outside air dampers for the heating, air conditioning, and ventilating units.
B. The damper frames shall be extruded aluminum not less than, 08" thick, thermally broken, roll-formed channel with prepunched slotted mounting holes. The damper blades shall be extruded aluminum insulated R-2.29.
C. Bearings shall be composed of a Celcon inner bearing with aluminum hexagon blade pivot pin, rotating within a poly carbonate outer bearing inserted in the frame. The dampers shall be equal to Tamco series 9000 ECT for parallel blade dampers and for opposed blade dampers.
D. Dampers shall have a closed leakage rate of not more than 1.4 CFM per sq. ft. for 3'x3' damper at 1" S.P leakage class 1A.

2.11 DIFFERENTIAL PRESSURE SWITCH

A. Differential pressure switches shall have adjustable set point and differential and be of the automatic reset, snap acting type as manufactured by Honeywell or approved equal.
B. +/- 5% accuracy, -1 to +1" P.G.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All control equipment shall be installed as recommended by the manufacturer and as required for service in the field. No equipment shall be concealed or covered by other equipment unless adequate provisions are made for service and replacement.
B. All wiring shall be run in neat, straight lines to present a finished appearance. Multiple runs shall be supported on brackets and spaced to give access to each line. Any work not neatly installed shall be removed and replaced.
C. All wires shall be color-coded and numbered on both ends of each conductor for easy identification. Colors and numbers shall not change in the middle of a run, unless an accessible junction box is provided. Provide numbered terminal strips in all control panels.
D. Wiring diagrams shall be prepared for all electrical connections, showing the actual wire number and terminal identification as installed. No less than three copies of such diagrams shall be delivered to the engineer as-built drawings.
E. Installation of all equipment shall be made by qualified mechanics familiar with control systems,

forces involved, and their operation.

F. All connections shall be made by technicians who are familiar with the operation of the equipment and the intent of the control designer.

G. After all equipment is mounted and connected, the control engineer shall inspect the system and verify the correct operation and connection of all equipment. Any equipment found to be installed improperly or connected incorrectly shall be changed as required. After the system is installed correctly, all instruments shall be calibrated and set points fixed at the correct setting.

3.02 TESTING/TRAINING

A. At the time of final review, the control contractor shall instruct the owner in the proper operation and maintenance of the system as installed and demonstrate how the system is designed to perform.

B. At completion of the training, the contractor shall submit a letter stating the owner has received proper training, date, time, and location of training and name of the trainee.

C. Any system found to be out of calibration or functioning improperly at this time shall be corrected immediately and the correct functions of the entire system demonstrated to the satisfaction of the engineer.

D. The ATC contractor shall provide two (2 hour) training sessions for systems orientation, product maintenance, trouble shooting, and emergency contacts. ATC contractor to coordinate with owner/architect/engineer to determine representatives/designated staff to be present for the training. ATC contractor to provide one training session during the heating (winter) season and one during the cooling (summer) season.

3.03 WARRANTY PERIOD SERVICES

A. Equipment, materials, and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance by owner.

B. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the ATC Contractor at no expense to the Owner.

C. The ATC Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The ATC Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work and description of the corrective actions taken. The report shall clearly certify that all systems/equipment are functioning correctly.

D. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

E. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

PART 4 - SEQUENCE OF OPERATIONS

4.01 GENERAL NOTES

A. The mechanical contractor shall retain the existing ATC sub-contractor (insert ATC contractor name here) to furnish all labor, materials, equipment, and service necessary for a complete and operating BAS, utilizing direct digital controls as shown on the drawings and described herein. The existing building BAS shall be connected to this building and provide standalone access using a standard web browser; HVAC system control, energy management, alarming, monitoring, trending and reporting functions with operator interface. The BAS shall include a web-based operator interface

depict each mechanical system and building floor plan by a point-and-click graphic. The web server shall reside on the building owner's network and shall be provided with an IP address by the owner. The web server shall gather data from the mechanical systems and generate web pages accessible through a conventional web browser on each pc connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. The BAS system shall provide:
   1. Stand-alone independent control for all mechanical systems as described in the sections that follow.
   2. Complete energy management software and firmware that resides and executes in networked field controllers. Operator workstation software shall not be utilized for energy management execution.
   3. Alarm management capability for all mechanical equipment described in the sections that follow – including alarm occurrence, annunciation, remote dial-out to remote sites or pagers, acknowledgement, problem diagnostics, and reporting functions.
   4. Complete password protected system monitoring through a local networked operator workstation, or through remote operator workstations. Remote workstations shall utilize telephone or internet or ethernet communications links, as required.
   5. Standard and customized manual or automatic reports of trends, runtimes, consumables, alarms, and system operator activities.
   6. The Mechanical Contractor shall submit equipment submittals of all mechanical equipment to the ATC Contractor for review prior to ordering the equipment.
   7. BAS web controller and main control panel shall be connected to 120v emergency power provided by the electrical contractor.
   8. All ATC wiring, components and installation shall comply with the national electric code.
   9. ATC contractor shall utilize low voltage conductors (solid or stranded) of the appropriate gauge and approved by the thermostat manufacturer.

4.02 INDOOR VAV AIR HANDLING UNITS WITH CHILLED WATER COOLING AND HOT WATER PRE-HEAT

A. General
   1. Air handling unit shall be provided with an open protocol BACNET controller.
   2. ATC contractor shall provide, install and wire the duct mounted pressure sensors for VFD operation.
   3. A duct mounted temperature sensor shall be shipped loose and field mounted in the supply ductwork to control the heating and cooling cycles of the unit.
   4. The unit shall be provided with outside air temperature, outside air dew point, "proof of flow" air flow and dirty filter sensors.
   5. ATC contractor shall provide, install and wire the chilled water and hot water pre-heat motorized two-way valves.
   6. Occupied/unoccupied shall be determined by the BAS time clock.
   7. The ATC contractor shall furnish and install a freezestat.

B. Operation
   1. The supply fan shall operate continuously in occupied hours and cycle in unoccupied hours/evening hours. The supply fan shall operate continuously and the supply fan VFD shall vary the fan speed in response to a signal from the supply duct mounted pressure sensor.
   2. Ventilation air - during occupied hours, the outside air damper shall be open. During the evening hours and unoccupied hours, the outside air damper shall be closed unless unoccupied cooling can be achieved via economizer.
   3. Air-side economizer - when the outside air temperature is lower than the space air temperature and the outside air dewpoint temperature is below 55ºF, the unit shall operate in 100% outside air mode with no mechanical cooling. ATC contractor to integrate remote relief

air controls.

4. Cooling - on a call for cooling, the chilled water coil shall maintain a minimum 55ºF (adj.) Leaving air temperature with the outside air damper in the minimum position to satisfy the space cooling requirements. The supply air temperature can be reset to 65ºF max if all cooling loads are satisfied.
5. Heating - on a call for heating, the control valves on the hot water pre-heat coil shall modulate to maintain 55ºF (adj.) Leaving air temperature with the outside air damper in the minimum position to satisfy the space heating requirements. If all spaces are satisfied for cooling, the heating supply air temperature shall be reset to 65ºF max.
6. "morning warm-up" mode
    a. The supply fan shall operate continuously and the outside air damper shall be closed.
    b. The BAS shall command all of the VAV boxes to fully open their inlet damper and the control valves on the hot water pre-heat coil shall modulate to raise the building space temperature to 70ºF (adj.).
    c. The outdoor air temperature sensor shall anticipate the warm-up start time to achieve occupied temperatures at opening.
7. Provide a duct smoke detector in each unit 2,000 CFM or over in the return air connection and in the supply air ductwork.
8. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.
9. The freezestat shall be wired with the fan starter. Whenever the air temperature upstream of the coils is 36°F, the fan shall stop, the outside air damper shall close and the chilled water and heating water valves shall open. A manual reset shall return the unit to normal operation.
10. Integrate with the BAS.

4.03 EXISTING HEATING HOT WATER CHILLED WATER SYSTEM PLANT

A. The existing heating hot water system plant shall continue to operate under its current sequence.

4.04 DUAL TEMPERATURE SYSTEM CHANGE - OVER

A. Furnish and install three-way control valves in the dual temperature supply and return piping which shall switch over dual temp water to circulate through the chiller or the convertor. Valves shall be two position.
B. Change-over from heating to cooling: Switchover shall occur from a manual (automatic) summer-winter switch at the Boiler Room ATC panel.
C. Change-over from heating to cooling: Provide a water temperature aquastat to monitor water temperature and to prevent flow to the chiller at temperatures above 85°F.
D. Integrate with the BAS.

4.05 FAN/COIL UNITS - HEATING AND COOLING

A. General:
    1. Fan coils shall be provided with an open protocol BACNET controller, 24V temperature controller, circuit setter and motorized control valves on the return piping.
    2. Each unit shall be provided with a wall mounted temperature sensor with slide adjustment and local override.
    3. Each unit shall be provided with a wire condensate overflow switch.
    4. Each unit shall be provided with motorized control valves. ATC contractor shall wire valves to the fan coil controller.

5. If the unit receives untempered outside air, it shall be provided with a freezestat.
6. Provide duct mounted smoke detector on the return, for units over 2,000 CFM.

B. Operation
1. The supply fan shall cycle.
2. Cooling: The fan coil controller shall modulate the chilled water 3-way (2-way) valve to maintain 72°F. (adj.)
3. Heating - on a call for heating, the unit shall modulate the heating hot water two or three-way valve to maintain 70°F. (adj.) In the apartment.
4. The condensate overflow switch mounted in the coil drain pan shall disable the unit whenever moisture is sensed. Fan coil unit must be manually restarted.
5. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.
6. The freezestat shall be wired with the fan starter. Whenever the air temperature upstream of the coils is 36°F, the fan shall stop, the outside air damper shall close and the chilled water valve shall open. A manual reset shall return the unit to normal operation.
7. Integrate with the BAS.

4.06 DUCTLESS SPLIT SYSTEM

A. General
1. The indoor unit shall be furnished with a wireless, wall mounted programmable 24 hr./7-day thermostat. ATC contractor shall install and wire thermostat.
2. ATC contractor shall wire outdoor unit to the indoor unit.
3. The unit shall include a low ambient kit. ATC contractor shall wire the outside air temperature sensor.
4. The units shall be circuited to standby power.
5. Ductless split system to be furnished with a BACNET network card.
6. Integrate with the BAS.

B. Operation
1. Cooling - on a call for cooling, the indoor unit shall operate to maintain 72ºF (adj.) In the space.
2. Heating - on a call for heating, the indoor unit shall operate to maintain 60ºF (adj.) In the space.

C. Integrate with the BAS.

4.07 EXHAUST FANS

A. General:
1. Fan status (on/off) and start/stop points shall be shown on the BAS workstation.
2. 0-10V speed controllers shall be furnished with each exhaust fan listed in the equipment schedule for balancing purposes.

B. Operation:
1. EF-X (bathroom) - the fan shall operate continuously during occupied hours at the low speed setting. When activated by the wall switch, the fan shall index to the higher speed to achieve the maximum airflow rate.
2. TF-1 (AV Booth Transfer Fan) - the fan shall operate when the space temperature rises above 85ºF (adj.). An alarm signal shall be sent to the BAS if the room temperature exceeds 95ºF.

C. Refer to exhaust fan schedule for specific controls descriptions.
D. Integrate with the BAS.

4.08 SMOKE DAMPERS (SD) AND COMBINATION FIRE/SMOKE DAMPERS (FSD)

A. Smoke dampers (SD) and combination fire/smoke dampers (FSD) shall be furnished by the mechanical contractor and installed by the mechanical contractor (or sheet metal sub-contractor). The electrical contractor shall provide 120V power to all smoke dampers and combination fire/smoke dampers (refer to electrical drawings). The fire alarm sub-contractor shall wire the smoke damper or combination fire/ smoke damper to the digital addressable fire alarm system.
B. Refer to cover sheet or equipment schedules for smoke damper and combination fire/smoke damper specification. Smoke dampers and combination fire/smoke dampers shall be power open, spring closed type (fail closed).
C. Smoke dampers and combination fire/smoke dampers shall be furnished with open / closed blade indication module (OCI). The fire alarm sub-contractor shall wire the OCI module to the addressable fire alarm system.
D. Addressable duct mounted smoke detectors or full area smoke detection shall be provided for each smoke damper and combination fire/smoke damper in accordance with international mechanical code section 607.3.3.
E. The addressable duct mounted smoke detectors shall be furnished by the fire alarm sub-contractor, mounted by the mechanical contractor (or sheet metal sub-contractor) and wired to the addressable fire alarm system by the fire alarm sub-contractor.
F. Do not integrate with the BAS.

4.09 UNIT HEATERS - HOT WATER

A. General - Refer to equipment schedule additional information.
B. Provide a wall mounted (or integral) thermostat which shall start and stop the unit heater to maintain space temperatures. Fan shall start and stop and control valve 2-way shall modulate open/closed to maintain space temperature.
C. Unit heaters in public areas such as stair towers, lobbies and vestibules shall be furnished with integral tamperproof unit mounted thermostats.
D. Unit heaters in mechanical rooms, electrical rooms and other back-of-house areas shall be furnished with wall mounted thermostats unless noted otherwise.
E. Do not integrate with the BAS.

4.10 CONVECTORS, CABINET UNIT HEATERS, EXTENDED FIN RADIATION - HOT WATER

A. General - Refer to equipment schedule for additional information.
B. Furnish and install a wall mounted thermostat which shall gradually modulate a two-way or three-way control valve to pass more or less hot water through the heating element to maintain space temperatures.
C. Baseboard/extended fan radiation heaters, wall convectors and cabinet unit heaters in stair towers, lobbies and vestibules shall be furnished with integral tamperproof unit mounted thermostats.
D. Do not integrate with the BAS.

4.11 FREEZESTATS

A. All units with chilled water or heating hot water coils within the units or duct mounted heating hot water coils shall have averaging freezestats on the leaving side of the water coil.
B. Whenever the air temperature upstream of the water coil is 36°F, the fan shall stop, the outside air damper shall close, the return air damper (if required) shall fully open, and the water valves shall open. A manual reset shall return the unit to normal operation.
C. The unit shall be de-energized, the outside air damper shall close, the return air damper (if required) shall fully open, and the hot water control valve shall fully open, if the freezestat falls below 36°F

(adj) degrees.

D. Integrate with the BAS.

4.12 DUCT MOUNTED SMOKE DETECTORS

A. In air systems with a capacity greater than 2,000 CFM, furnish and install duct mounted smoke detectors in the supply air (downstream the air filters and upstream of any branch duct) and return air ductwork.
B. The fire alarm sub-contractor shall furnish a fire alarm monitoring module for each required air handling system. The ATC Contractor shall wire the fire alarm monitoring module to the emergency shutdown contacts or combination motor starter/disconnect on each air handling system.
C. Detectors shall de-energize the unit and signal the addressable fire alarm system if smoke is detected.
D. Detectors shall be accessible. Mechanical contractor shall be responsible for providing all necessary access panels and doors.
E. Duct smoke detectors to be furnished by the Electrical/ Mechanical Contractor.
F. Integrate with the BAS.

4.13 SPACE HIGH TEMPERATURE AND HIGH HUMIDITY SENSORS/ALARMS

A. Furnish and install wall mounted high temperature and high humidity sensors in the spaces where indicated on the drawings. An alarm shall be sent to the BAS when limits exceed setpoint settings.
B. Integrate the sensors and alarms with the Building BAS.
C. Integrate with the BAS.

4.14 VARIABLE FREQUENCY DRIVES

A. Application: Heating hot water pump (s), chilled water pump (s) and dual temperature pump (s).
B. Refer to the variable frequency drive specifications for additional information and points.
C. Control points as a minimum.
    1. VFD Speed (H2)
    2. VFD Amps
    3. VFD RPM
    4. Run time (hrs.)
    5. Drive Temperature.
    6. Drive Command
    7. Current Amps.
    8. KW
    9. Alarms/faults
    10. Emergency override stats.
    11. Hand/Off/Auto Status.
D. Integrate with the BAS.
E. ATC Contractor to provide Modbus interface.

END OF SECTION