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c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point

3. Operation and Maintenance (O&M) Manual. Printed and electronic PDF documentation of the following:

    a. As-built versions of submittal product data.

    b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.

    c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.

    d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

    e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

    f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.

    g. Graphic files, programs, and database on magnetic or optical media.

    h. List of recommended spare parts with part numbers and suppliers.

    i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.

    j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.

k. Licenses, guarantees, and warranty documents for equipment and systems.

l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

4. Ownership Of Proprietary Material

a. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics

2. Record drawings

3. Database

4. Application programming code

5. Documentation

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An independent contractor who is an automatic control system manufacturer's authorized representative and is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DDC system components.

D. Comply with BACnet, and Niagara communication protocols for each DDC system component.

E. Wiring shall be a Class A installation per the requirements of NEC and Division 16.

F. Generic End Devices input devices and controlled devices. Includes temperature, humidity, pressure, flow sensors for input, valve and damper actuators, etc. for output. For a retrofit project, all existing end devices and wiring thereto can be re-used by the contractor provided they are compatible with installed BAS product. Confirm that existing sensors meet the criteria in other parts of this document. Notify the engineer of any end

with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)
    a. Section 719 Ducts and Air Transfer Openings
    b. Section 907 Fire Alarm and Detection Systems
    c. Section 909 Smoke Control Systems
    d. Chapter 28 Mechanical
3. For BACnet systems, ASHRAE/ANSI 135-2001: Data Communication Protocol for Building Automation and Control Systems (BACNET)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 CONTROL SYSTEM

A. Acceptable DDC System Manufacturers:

1. Schneider Niagara by Dynamic Controls
2. Honeywell installed by Honeywell.
3. Niagara or Lynxpring by Dynamic Controls

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation perm 1 9 792 reo/F1 91(A)-2(n)6( )-101(o)-3(p) 0 0 1 144.02 145.82 Tm0 g0 G[(m)-6(u)-3

response times and to manage the flow and sharing of data without

E.The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

F. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support unlimited simultaneous users.

G. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network, telephone connection, or wide-area network.

3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:

a. To alarm

b. Return to normal

c. To fault

4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.

5. Provide timed (schedule) routing of alarms by class, object, group, or node.

event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

H. Control equipment and network failures shall be treated as alarms and annunciated.

I. Alarms shall be routed by the BACnet IP network to the EBI alarm server in any of the following manners:

1. Screen message text

2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:

a. Day of week

b. Time of day

c. Recipient

J. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date

2. Location (building, floor, zone, office number, etc.)

3. Equipment (air handler #, accessway, etc.)

4. Acknowledge time, date, and user who issued acknowledgement.

5. Number of occurrences since last acknowledgement.

K. Alarm actions may be initiated by user defined programmable objects created for that purpose.

L. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

M. A log of all alarms prog se

when not installed in panel. Seimens series CK or Engineer-approved equal.

B. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with overcurrent protection with a resetable circuit breaker.

C. Manual control switches shall be UL listed for use in NEMA 1 enclosures with contact arrangement and rating suitable for application. Bat handle or knob actuator with nameplate clearly indentifying function of each switch position.

D. Power Supplies:

1. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 MV maximum P-P. Regulation shall be

G. Equipment safeties (freeze, smoke detectors, etc.) will be hardwired into the start circuits for equipment shutdown. All safety devices will be 2-pole devices one to shut down equipment and one to alarm the BAS.

2.06 ELECTRONIC SENSORS

a. MAMAC Systems, Inc.

b. Schneider Electric

c. Siemens

d. Honeywell

2. Accuracy: Plus or minus 0.2 percent at calibration point.

3. Wire: Twisted, shielded-pair cable.

4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

7. Electropneumatic Transducers: 100% solid-state piezorestive silicon pressure sensor, high air flow capacity (output of 25psig), field selectable 4 to 20 mA, o to 5 VDC or o0 to 10 VDC input. For service with HTHW control valves.

8. Electropneumatic Transducers: 100% solid-state piezorestive silicon pressure sensor, low air flow capacity (output of 15psig), field selectable 4 to 20 mA, o to 5 VDC or o0 to 10 VDC input.

E. Occupancy Sensor: Passive Qt0 g0TJETO4 150

2.08 GAS DETECTION EQUIPMENT

A. Manufacturers:

1. AirSense by Honeywell International Inc.

3. Schneider Electric

4. Honeywell International Inc.

5. Vulcain Inc.

6. Macurco

B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130

Provide external, manual gear release on nonspring-return actuators.

7. Power Requirements (Two-Position Spring Return): 24-V ac.

8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.

9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.

10. Temperature Rating: Minus 22 to plus 122 deg F.

11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.

12. Run Time: 12 seconds open, 5 seconds closed.

2.12 CONTROL VALVES

A. Manufacturers:

1. Schneider Electric
2. Belimo
3. Fisher
4. Honeywell

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

a. Single-Seated Valves: Cage trim provides seating and

guiding surfaces for plug on top and bottom.

b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:

a. Two Position: Line size.

b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.

c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Lug.

2. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.

2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.

3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.13 DAMPERS

A. Manufacturers:

1. Greenheck

2. Ruskin

3. Honeywell

B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.

3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.14 DATA COLLECTION AND STORAGE

A. The NAC (Network Area Controller) shall have the ability to collect data for any property of any object and store this data for future use.

1. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

2. Designating the log as interval or deviation.

3. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

4. For change of value logs, the object shall be configured to trigger on a change of a variable to a fixed value. This value, when reached, will initiate logging of the object.

5. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.

6. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined evf1 0first

2.15 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date

2. User ID

3. Change or activity: i.e., Change setpoint, add or delete objects, commands, programming changes, etc.

2.16 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.17 GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System:

1. The GUI shall run on Microsoft Windows NT Workstation 4.0,

4. Enable or disable control strategies.

5. Generate hard copy records or control strategies on a printer.

6. Select points to be alarm able and define the alarm state.

7. Select points to be trended over a period of time and initiate the recording of values automatically.

E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict

application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console

1. Alarms are to be routed to EBI server via BACnet IP and N4 supervisor station via BACnet IP or Niagara network. The use of the Alarm Console can be enabled or disabled by the system administrator.

2.18 WEB BROWSER CLIENTS

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manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page

slider, without requiring any keyboard entry from the operator.

2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

c. View logs and charts

d. View and acknowledge alarms

determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.19 SERVER FUNCTIONS AND HARDWARE

A. A central server shall be provided where required effective for NAC communication over the Ethernet. The server shall support all Network

local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from the Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

D. The server shall provide the following functions, at a minimum:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.

2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).

4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.

6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

7. The server shall implement the BACnet Command Prioritization

b. Exporting log data to other software applications

c. Query log data based on user-defined parameters

2.20 SYSTEM PROGRAMMING

A. Only Niagara software modules allowed for Niagara programming and graphics. No Aftermarket modules allowed.

B. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

C. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the

-time

data value 0S788object8(te(0S783p)-3(ro))-4(h/F1 124≥30057052-0)-3(y)-91(b)6()-91-3(

appl1(-3(il)4(itle.TJETQq0.00000912 0 612 792 reW*nBT/F1 12 Tf1 0 0 1 133.22 397.93 T25.5 T0 G[a)-3(p)ETQ E

be accepted.

3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the

BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to

exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override leau:@Åñ13L:@Zéä£a'G2SSq32VNm3cfVSjc

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zigzag pattern.

D. Install guards on thermostats or blank plate sensors in the following locations:

1. Entrances.

2. Public areas.

3. Gymnasiums

4. Locker rooms.

E. Install automatic dampers according to Division 15 Section "Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Div1s 792 reW*nBT/F1 12 Tf1 0 0 1 riop 1 1 -351("5o3.22 441.67 Tme)o3.22 1 06oon 1

protocol using all points available.

3.02 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."

B. Install building wire and cable according to Division 16 Section "Conductors and Cables."

C. Install signal and communication cable according to Division 17 Section "Voice and Data Communication Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway.

3. Install concealed cable in raceway.

4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

8. If no IP device is located in mechanical room, we need one CAT-6 Data drop for connection to BAS for troubleshooting purposes.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

F. Wire labeling of signal points and location at both ends.

G. Interconnections between internal and face-mounted devices prewired with color-coded stranded conductors neatly installed in plastic troughs

and/or tie wrapped. Terminal blocks shall be provided for all field connections, and shall be UL listed for 600-volt service, individually identified per control drawings, with adequate clearance for field wiring.

1. Control terminations for field connection shall be individually identified per control drawings.

2. All internal wiring between panel mounted devices and field terminal blocks shall be marked on both ends with the appropriate identifying tag.

H. Internal panel components shall be securely mounted. Each component shall be individually labeled with function and device identification, as shown on the control drawings.

3.03 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

2. Check instruments for proper location and accessibility.

3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

4. Check instrument tubing for proper fittings, slope, material, and support.

25. Interface with job-specific, third-party operator software

26. Add new users and understand password security procedures

K. Divide presentation of objectives into three sessions (1-13, 14-

B. The contractor will submit the commissioning procedure and blank log book for approval prior to starting commissioning work.

C. The contractor will start with a verification of the control inputs and

n. HTHWR control valve @ domestic hot water heaters

o. HTHW system meters at building entry

p. Domestic hot water temp

q. Domestic hot water recirc. temp

r. Domestic hot water circ. pump status

s. Outdoor air tem

t. Domestic water booster pump

4. Air Handling Equipment:

a. Supply fan start/stop

b. Supply fan status

c. Supply fan VFD modulation

d. Supply fan differential static pressure

e. Return fan start/stop

f. Return fan status

g. Return fan VFD modulation

h. Return fan low limit

i. Pre filter DP

j. Supply air temp

k. Heating coil control temp

l. Outdoor air temp

m. Return air temp

n. Outdoor/return air damper

o. Exhaust air damper

p. Cooling coil control valve

q. Mixed air temp

r. Freeze stat alarm

s. Exhaust fans start/stop (all)

t. Exhaust fans status (all)

u. Smoke detector SA

v. Smoke detector RA

w. Supply fan high limit alarm

x. AHU space served room space temp at several locations

2. Miscellaneous Systems **(COORDINATE WITH WORK OR**