Energy Zone®

Energy Management and Control System

Sample Section
15900 Specification

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ENERGY MANAGEMENT CONTROL SYSTEM (EMCS)

PART I - GENERAL

1.01 SCOPE

A. CONFORM: To General Conditions, Supplementary Conditions and Division 1 - General Requirements.

B. SECTION INCLUDES: Instrumentation, temperature controls, and energy management for all HVAC units and other energy consuming equipment.

C. EXTENT: The control system shall consist of the IBM PC-AT Compatible Computer, Remote System Controllers (RSC), sensors, automatic valves and dampers with actuators, operating software, operator training, installation labor, warranty, and all other necessary material and labor to provide a complete workable system.

D. MANUFACTURER: Provide a complete building automation system manufactured by Building Automation Systems (Phone: 360-943-2952) and installed by factory authorized and trained technicians.

E. ALTERNATE BIDDERS: Alternate bidders must include all hardware and software functions as described in the base bid. All alternate bidders must obtain ten day prior approval and be listed in addendum. Alternate bidders shall provide the engineer a letter stating that they are familiar with the control specifications and that they will assume full responsibility for meeting all requirements. This shall include all equipment data cuts sheets of proposed system. Wording such as "will meet or exceed specified equipment" without data will not be accepted. Bidders must be the contractual authorized representative of the proposed system with factory trained personnel employed in the local office.

1.02 SYSTEM DESCRIPTION

A. GENERAL: Provide a distributed processing system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software. This system is to be capable of controlling all HVAC equipment (heat pumps, air conditioners, unit ventilators, return fans, dampers, pumps, exhaust fans, etc.) and other specified equipment directly, without intervening conventional controls. System shall be completely pre-calibrated with no controller setpoint adjustments or calibration required.

B. BASIC SYSTEM FEATURES

1. System shall use software operating in the Microsoft Windows multitasking environment. This will allow use of the Central Processing Unit (Command Center) for routine office tasks simultaneously with building energy management.
2. One model of the Remote System Controller (RSC) shall be configurable for control of all equipment. Multiple versions of field controllers are not acceptable.
3. Each RSC shall be provided with control algorithms preprogrammed for all listed Equipment Schedules.
4. All system software and hardware components shall be fully Year 2000 compliant.
5. All system components shall be UL listed. UL recognized controllers are only acceptable if included as a component of a UL certified control panel.

1.03 SUBMITTALS

A. FORMAT: Make submittals in accordance with Section _____.

B. EQUIPMENT LIST: Furnish a complete list of equipment to be furnished including a manufacturer's catalog sheet for each item on the material list.

C. ENGINEERING DRAWINGS: Provide a complete set of engineering drawings, prior to installation, for approval that will include the following information:

1. Interconnect drawings:
   a. Show all field wiring and interconnecting equipment and devices.
   b. Identify the type and size of wire and assign unique numbers or colors to every wire.
   c. Identify equipment and devices by the reference designators shown on the plan drawings.
2. Wiring diagrams:
   a. Show internal wiring of all panels.
   b. Show general physical arrangement of component devices installed in the panels.
   c. Provide partial elementary ladder diagrams to show the function of circuits employing switching logic.
   d. As built Drawings: Within 10 days prior to final acceptance, update the engineering drawings to reflect the actual "as-built" condition and deliver three copies to the Mechanical Contractor for distribution.

1.04 INSTALLATION AND QUALITY

A. GENERAL: The control equipment and connecting wiring shall be installed in a neat workmanlike manner by trained mechanics under direct supervision of the Energy Management Control System (EMCS) Contractor, conforming to all applicable state and local codes.

B. CONTROL WIRING AND CONDUIT: All wiring and conduit shall be installed in accordance with the National Electrical Code and all applicable local codes. All control wiring in mechanical rooms shall be installed in raceway unless specifically noted that it is acceptable to run exposed.

C. VALVES AND WELLS: Automatic temperature control valves and separable wells for immersion elements furnished by the EMCS Manufacturer shall be installed by the Mechanical Contractor under the EMCS Contractor's supervision.

D. DAMPERS AND OTHER CONTROL DEVICES: All automatic dampers and other air control devices furnished by the EMCS Manufacturer shall be installed by the Mechanical Contractor, or the Sheet Metal Contractor, under the EMCS Contractor's supervision. Dampers shall be linked to the damper motor by the EMCS Contractor.

E. PAINTING: All finish painting required for the temperature control piping and equipment shall be provided by others as specified in Section _____.

F. CONCRETE WORK: Any concrete work required for completion of the temperature control portion of the work shall be provided by the Mechanical Contractor in accordance with drawings supplied by the EMCS Contractor.

G. LINE VOLTAGE: All Line Voltage electrical circuits shall be installed by Division 16.

1.05 POST INSTALLATION INSTRUCTION

A. UPON COMPLETION: The Energy Management Control Contractor, in conjunction with the HVAC representatives, shall instruct operating personnel in the operation of the system. The EMCS Contractor shall provide 16 hours of on-site training in the operation of the system for maintenance personnel and other employees as deemed necessary by the administration.

1.06 OPERATION AND MAINTENANCE MANUALS (O&M)

A. MANUALS: At final acceptance and system turnover, deliver to the Mechanical Contractor the required number of bound copies of the O&M, describing the operations, maintenance and servicing requirements of the overall systems and all equipment provided. Provide the following information in separate section each with tab index:

1. Material list.
2. Technical literature for all equipment including catalog sheets, calibration, adjustments and operation instructions, and installation instructions.
3. A list of spare parts recommended for purchase by the owner.
4. System description and complete sequence of operation.
5. Reduced size (8 1/2" x 11") copies of as-built engineering drawings.
6. Input/output (I/0) summary forms for the system listing all connected analog and digital input and output functions and the types of all points.
7. Control programs specific to this system.

1.07 SERVICE AND GUARANTEE

A. TWO YEAR WARRANTY: The control system herein specified shall be free from defects and workmanship and material under normal use and service. If within twelve (12) months from the date of completion any of the equipment herein described is proved to be defective in workmanship or materials, it will be repaired or replaced free of charge. If within twenty-four (24) months from the date of completion any of the equipment herein described is proved to be defective in workmanship or materials, it will be repaired or replaced for the cost of labor only.

B. ADJUSTMENTS AND SERVICE: After completion of the installation the EMCS Contractor shall regulate and adjust all thermostats, control valves, control dampers and other equipment provided under the EMCS contract. The EMCS Contractor shall provide any service incidental to the proper performance of the control system under guarantees outlined above for the period of one year. Normal maintenance of the system or adjustments or components is not to be considered part of the guarantee.

C. SERVICE AGREEMENT: The EMCS Contractor will make available to the owner an annual service agreement covering all labor and material required to efficiently maintain the control system during and after the warranty period.

PART II - DIRECT DIGITAL CONTROL SYSTEM (DDC)

2.01 BASIC SYSTEM

A. GENERAL: The Direct Digital Control System (DDC) shall be fully integrated and installed as a complete package of controls and instrumentation. The system shall include all computer software and hardware, operator input/output devices, sensors and controls required for complete operation. The EMCS contractor shall provide all low voltage wiring, installation (except those items noted elsewhere), supervision and labor including calibration, adjustments, operator training and checkout necessary for a complete and full operating system.

B. SYSTEM STRUCTURE

1. The system shall be a complete, stand-alone Energy Management and Temperature Control System consisting of:
   a. Command Center which utilizes state-of-the-art technology, simple user-friendly operation, high reliability and modular construction.
   b. Remote System Controllers (RSC) located at each control zone.
   c. Software utilizing a graphical user interface and requiring only simple fill-in-the-blank configuration for all system operations.
2. The basic elements of the system structure shall be built up only on standard components kept in inventory by the supplier. The components shall not require customizing other than setting switches and configuring the software to perform required functions.
3. The system shall be a true distributed processing system. All software control functions to be performed by the RSC. Control software to be in nonvolatile memory. The RSC shall communicate with the Command Center. There shall be no system hardware necessary between the Command Center and the RSC.

C. OPERATING SYSTEM

1. The system software shall operate in the Microsoft Windows (Windows 98 or any more recent release) environment. The system shall allow the Building Energy Management System to operate in the background while the system operator runs any standard Windows based application. The system shall be notified of any system alarm or off-line occurrence, regardless of any current application being run.

D. COMMAND CENTER

1. The Command Center is to be a standard, IBM PC-AT compatible computer with a minimum 2 gHz Pentium processor. Unit to have auto start-up feature. Locate system Command Center as indicated on drawings or directed by the owner's representative. Include the following features as standard:
   a. Minimum 128MB RAM
   b. 20 gigabyte internal hard disk drive
   c. CD-ROM drive
   d. 1.44MB 3 1/2" disk drive
   e. 56K baud fax modem
   f. 1 Parallel/1 Serial/1 USB port
   g. Battery backed up clock/calendar
   h. Local bus accelerated VGA graphics and color monitor
   i. Mouse

E. REMOTE SYSTEM CONTROLLER (RSC): The RSC shall communicate directly with the Command Center and also be stand-alone, maintaining its own control strategy in the event of communication failure with the Command Center. The RSC shall contain built in RAM and ROM. The RSC shall be capable of controlling any type of HVAC device. The program shall be changed by simply repositioning of dip switches and all RSCs shall be interchangeable. The RSC shall contain at least eight analog and eight digital inputs, eight digital outputs, and four analog outputs. Each RSC shall be linked by a single pair of wires. All RSCs shall have default control software which is dip switch selectable.

F. CAPABILITY: The EMCS shall monitor and control all functions relating to Building Automation, Temperature Control and Energy Management as specified. The system RSCs shall directly control all HVAC units, duct damper actuators, valve actuators, pumps, cooling tower, boiler, exhaust fans and other specified equipment. The sequence of operation precisely identifies all points of monitoring and control. The point monitoring and controlling functions to be performed by the system shall include but not be limited to the following capabilities:
1. 8 Digital inputs (contact closures)
2. 8 Analog inputs (varying voltage/current/resistance/pneumatic signals)
3. 8 Digital outputs (start/stop or 3 point floating using digital timing)
4. 4 Analog outputs (varying voltage/current/resistance/pneumatic signals)

G. CAPACITY: The base system shall have a minimum 7680 point capacity without the addition of any components other than RSCs. The base system shall have the capability to control up to 1024 HVAC zones. Additions to system shall be accomplished by adding subsequent RSCs while system is on line.

H. FAILURE: Upon failure of any RSC, system shall display off line occurrence for each individual affected point at the Command Center. Provide routine communication verification for each RSC. In event of Command Center failure, each RSC shall operate in stand-alone mode operating equipment at default values.

I. OPERATOR INTERFACE: The system is to be fully menu-driven. All system titles, prompts, and instructions to be in English language and user friendly. All entries to be in natural units, i.e., a setpoint value shall be entered in its actual control value, such as 74 F. All operator commands, changes, and data displays identified in the sequence of operation shall be available and executable at a single operator's station.

J. SYSTEM CONFIGURATION: All system configuration shall be through menus with user prompted dialog boxes. Programming experience shall not be necessary for any modifications or additions to the system.

K. REMOTE OPERATION: All functions of the Command Center shall be available by remote control via standard modem communications. The system Command Center shall automatically inform the remote central system of alarm conditions and report unit identifier and alarm status upon occurrence. The remote Command Center shall exactly duplicate all capabilities as are provided by the local Command Center. Provide modem for remote monitoring during warranty period. The owner shall provide a dial-up telephone line for EMCS contractor monitoring of system during one-year warranty period.

L. REMOTE ALARM CALLOUT: Any alarm can be configured to callout to a standard digital pager or a standard fax machine.

M. LOCAL TESTING/TROUBLESHOOTING: A portable handheld terminal can be plugged into the RSC to allow for local monitoring of all RSC functions and input of test signals for troubleshooting. The handheld terminal shall be powered from the RSC.

2.02 ENERGY REDUCTION SOFTWARE

A. GENERAL: The EMCS shall be designed to control all equipment for which significant energy savings can be achieved, equipment which is involved in building temperature control, or equipment which is otherwise specified. This shall be accomplished utilizing a combination of different methods. Provide engineering, consulting, programming and training time to develop and implement the following energy reduction software.

B. SCHEDULING

1. Time Schedules: The EMCS shall have the capability to provide 32 different weekly schedules. Each schedule to be 8-day type, 4 entries per day. All entries to be in 24 hour format. Each complete schedule shall be displayed at one time on the Command Center for easy editing.
2. Holiday Scheduling: System shall have the capability to program holidays for a minimum of 20 years in advance. Holiday schedule will display each month and allow for easy editing. The 10 federal holidays shall be pre-programmed through the year 2010.

C. DEMAND LIMITING: Provide kW demand limiting software. System shall support at least eight demand meters. Any piece of controlled equipment can be cycled by the demand limiting software. Provide control of maximum and minimum temperatures and duty cycling of shed equipment.

D. SETBACK RECOVERY WITH ADAPTIVE OPTIMUM START

1. Morning Warm-up: The system shall monitor the outdoor air temperature and zone temperature to calculate the time to turn on each individual HVAC unit based on past optimal start cycles. By specifying building occupancy times and temperature, the system shall control comfort levels to meet these guidelines. The system shall monitor setback recovery performance and adapt future recovery times based on zone history.
2. Morning Cool-down: HVAC equipment shall operate in economizer cooling mode when available and as required to reduce space temperature.

E. ECONOMIZER CONTROL

1. The system shall monitor outside air enthalpy at a single point and return air enthalpy for each zone with an economizer.
2. On a call for cooling from the zone, the system shall compare enthalpy of the outside air with enthalpy of the zone. If enthalpy of outside air is lower, modulate outside air and relief dampers open, and return air damper closed. If enthalpy of outside air is higher than zone air, maintain outside air dampers at minimum position.

F. OUTDOOR AIR RESET CONTROL: Provide reset of controlled temperature, based on outside air temperature.

G. LIGHTING CONTROL: Provide the capability to control interior and exterior lighting systems. In addition to standard time-of-day ON/OFF control, interior system control shall flash the lights 5 minutes before entering the Unoccupied Mode. This feature shall provide the tenants sufficient time to exit the building or press the setback override button prior to the lighting being turned OFF.

2.03 MISCELLANEOUS FUNCTIONS

A. AUTOMATIC CONFIGURATION: The addition of any RSC on the network shall be automatically recognized by the Command Center. The dip switches at the RSC shall be read by the Command Center to determine equipment type and a configuration file created for that zone using system defaults. No additional configuration shall be required, except for addition of an optional zone description on the main list box. All advanced control features such as PID control, adaptive setback recovery, zone high and low temperature alarms, trend and alarm logging, holiday schedules, and weekly schedules shall be provided with the default configuration.

B. AUTOMATIC RESTART: The system shall automatically restart following a power failure, with no User intervention required.

C. NO PROGRAMMING REQUIRED: System shall have complete capability to modify all system control parameters through a User prompted fill-in-the-blank and a point-and-click graphical interface. No programming and no additional equipment or software shall be required.

D. ALARM CAPABILITIES

1. For each input and output point, provide operator assignable high and low alarm limits, delay time, and time of day mode for alarm condition.
2. For each alarm, provide the following assignable alarm responses:
   a. Display alarm message including programmable alarm description, time of occurrence, current point value at time of alarm, address, room #, and description of zone.
   b. Send above alarm message to fax machine at remote location. Alarm message shall be sent in addition to the status of all inputs and outputs in that zone at the time of alarm.
   c. Print above alarm message.
   d. Store above alarm message in alarm log on hard disk.
   e. Call alarm to digital pager.
   f. Change the position or status of any output in the system.

E. DYNAMIC GRAPHICS: A dynamic graphic software package shall be provided. The Graphic Builder software shall have the capability of constructing and viewing floor plan drawings, mechanical equipment piping diagrams and mechanical systems drawings while system is on line. The Graphic Viewer shall display current point data information. The graphics system shall be capable of providing the user access to all system commands, configuration data, and current zone operational data.

F. TEMPERATURE CONTROL: Proportional, integral, and derivative control modes are standard. Proportional, integral, and derivative gains can all be changed for each control zone. The User can also change the cycle rate (cycles per hour) and derivative look back time. A zone history graph, to aid the User in PID loop tuning, shall be available for all zones.

G. LOGS

1. Trend Log: Provide a trend log. Operator may assign any RSC for storage. Provide for review of data on CRT and printer. System shall automatically begin entry into each log as scheduled. Each point in the log shall have unlimited entries, all data stored on the system hard disk for future retrieval. Create a new trend log at the beginning of each month. The Trend Log shall be configurable for any time interval from 1 second to 1 week.
2. Current Alarm Status: Display all points currently in alarm.
3. Alarm History: Log all alarm occurrences for the current month. Create a new alarm log at the beginning of each month.
4. A Runtime log shall include the total run time of all digital outputs, recorded to the nearest second.
5. A Security Log shall record all system access and all RSC configuration.
6. An Override Log shall record all setback override conditions and total all override time monthly by zone.

H. DYNAMIC DATA EXCHANGE: All inputs, outputs, and most configuration data from all RSCs shall be available to any Windows application that conforms to the Microsoft Dynamic Data Exchange specification.

I. PASSWORD/SECURITY: Provide a programmable password which can accept alpha-numeric characters. Password will not be needed for access to monitoring programs. Provide a minimum of six levels of security. Automatically log-off if no activity for 30 minutes (programmable).

J. VARIABLE AIR VOLUME: Variable air volume systems shall be provided with the following additional software features:

1. Pressure Independent Damper Control - All VAV or VariZone RSCs can be selected to use either pressure dependent or pressure independent damper control.
2. Terminal Regulated VAV Control - This feature uses input from all of the clients (zone dampers) to reset a variable frequency drive on the VAV server (rooftop air handler). The duct static pressure is allowed to vary, within preset limits, to the minimum necessary to satisfy the clients.

K. REAL-TIME CLOCK/BATTERY STANDBY POWER: Real-time clock shall be self-contained and accurately controlled by a quartz crystal. The clock shall be set via the keyboard and may be viewed on the display. A battery standby power supply shall be used to maintain clock operation when primary power fails. When primary power returns, the system shall automatically "reboot" to the appropriate schedules and require no action from maintenance personnel to re-initialize. Battery back-up shall be provided for 30 days of clock operation.

2.04 CONTROL COMPONENTS

A. TEMPERATURE SENSORS

1. All temperature sensors are to be solid state electronic transmitters, integrated circuit temperature sensors, providing precise inherent calibration, and be totally changeable. Wall sensors to be protected by a tamperproof enclosure. Duct sensors to electronically identical, housing suitable for the application. Metal guards shall be provided as shown on drawings.
2. Zone sensor to contain push-button bypass switch. The operator shall program the time of override operation at the keyboard from 0 to 15 hours. Operator shall be able to alter override time or return area to automatic control.

B. ENTHALPY SENSORS: Enthalpy sensors are to be solid state and combine temperature and humidity of air system in which sensor is located. Provide one sensor for outside air and one sensor for the return air of each unit with an economizer.

C. CONTROL DAMPERS: Provide low leakage control dampers. Dampers shall have blade seals and stops with all aluminum construction.

D. CONTROL VALVES: Control valve shall be correctly selected for service and flow of system served. Cast iron body in corrosive environments, provide opening and closing rate control where shown. Provide spring return where noted as normally open or normally closed.

E. DAMPER AND VALVE ACTUATORS: Provide actuators in sufficient size, quantity, and type matched to application. Proportional or 3 point floating as required.

F. ENCLOSURES: All enclosures to be UL listed and rated for the environment in which they are installed.

G. CONTROL RELAYS/CONTACTORS: Shall be the single coil electrically operated. Number of contacts and rating shall be selected for the application intended.

H. AIR FLOW SWITCHES: General purpose utilizing differential air pressure, adjustable 0.1 in. W.C. to 2.0 in., neoprene diaphragm, all aluminum construction.

I. BUILDING POWER MONITOR: Power monitor to be provided by the serving electric utility. Power monitor shall measure line voltage, current and power factor with ability to internally compute consumed energy. Output pulse proportional to kWh used. Maximum error +/-.5% full scale. EMCS contractor to interface output pulse to the EMCS.

PART III - EXECUTION AND SEQUENCE OF OPERATION

3.01 ALL HVAC UNITS

A. GENERAL: Provide and install devices, relays, switches, sensors, dampers, conduit, and wiring to provide a complete and operating DDC system.

B. EACH HVAC UNIT: Shall be controlled via a wall mounted electronic sensor with override push-button. Sensors shall provide associated RSC with current temperature status. RSC shall directly and individually control all necessary HVAC components.

C. DEMAND CONTROL: Demand control shutdown signal from the EMCS shall de-energize significant electric loads (electric heat, compressors, etc.). Each HVAC unit shall be independently controlled and scheduled. Fans shall continue to operate. Demand control remains in operation under all modes of operation.

D. INTERLOCKS: See interlock schedule on plans for list of interlocked exhaust fans. Interlock exhaust fans through the EMCS. System shall be able to independently schedule or interlock fans through the Command Center.

E. ADDITIONAL CONTROLS/INDICATION: In addition to the below listed sequence of operation, provide the following through the EMCS operator's terminal for each HVAC unit.

1. Zone space temperature indication
2. Adjustment of heating and cooling setpoint, both occupied or unoccupied heating
3. Current mode (heating, cooling or at setpoint)
4. Status of all inputs and outputs
5. Time scheduling of each zone, normal and holiday
6. Local override of zone, programmable 0-15 hours
7. Log of override usage
8. Proportional/Integral/Differential control action
9. Digital and analog alarm processing
10. Alarm history
11. Trend logs
12. Floor plan and system dynamic graphics
13. Damper positions
14. Mixed air temperature
15. Adjustment of minimum damper position
16. Warm-up and economizer cycle control

3.02 TYPICAL HVAC UNITS

A. OCCUPIED VENTILATION CYCLE: When both the occupied heating and cooling setpoints have been met during the occupied period, the unit is in a ventilation mode. The outside air damper is at minimum position and the fan is running.

B. OCCUPIED HEATING: On a demand for heat, heat shall be staged on. Fan shall operate continuously. When the heating setpoint has been achieved, the heat shall be staged off.

C. OCCUPIED COOLING: On a demand for cooling, the return air dampers shall modulate closed, and the outside air dampers shall modulate open, as long as the enthalpy of the outside air is acceptable for cooling. When the enthalpy of the outside air is too high, the outside air dampers shall maintain minimum position and the cooling shall be staged on. Fan shall operate continuously. When the cooling setpoint has been achieved, return the outside air damper to the minimum position and/or stage the cooling off.

D. UNOCCUPIED CYCLE: Provide independent night setback operation for each HVAC unit. Fans, heat, and cooling system shall intermittently cycle with return air dampers open and outside air dampers closed to maintain minimum room temperature. Provide each unit with a room by-pass switch to restore day mode. 0-15 hour by-pass time period shall be adjustable from the CRT.

E. WARMUP MODE: Upon a zone optimal start signal from the EMCS, based on outside and individual zone room temperature, the fans shall run continuously. The heat shall cycle as necessary to maintain calculated warm-up ramp. The outside and exhaust dampers shall remain closed on warm-up. System shall monitor performance of the recovery in each zone. System shall store history and modify the next days recovery based on actual prior performance.

3.03 LIST OF EQUIPMENT SCHEDULES

A. Provide system with preprogrammed, dip switch selectable, control algorithms for all of the following listed HVAC equipment:

#1- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling
#2- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating
#3- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling, 2 Units
#4- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating, 2 Units
#5- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Cooling
#6- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Heating
#7- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Cooling
#8- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Heating
#9- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer
#10- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer, 2 Units
#11- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, Economizer (Stg or Anl)
#12- Air Conditioner, Single Zone or **VariZone®** Server, 2 Stages Cooling, 2 Stages Heat, Economizer (Stg or Anl)
#13- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator
#14- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator, 4 Zones
#15- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

#16- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#17- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#18- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#19- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#20- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#21- Fan Coil, Heating, 4 Units
#22- Fan Coil, Cooling, 4 Units
#23- Unit Ventilator, Electric Heat, Economizer (Stg or Anl)
#24- Unit Ventilator, Electric Heat, Economizer (Stg or Anl), 2 Units
#25- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator
#26- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator, 2 Units
#27- Unit Ventilator, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer,
#28- Unit Ventilator, Hydronic Heat, Modulating Economizer, 3 Point Floating or Analog Actuators
#29- Air Handling Unit, 4 Stage Heat, Outdoor Reset
#30- Air Handling Unit, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#31- Air Handling Unit, 3 Stage Heat, Modulating Cooling, Modulating Economizer, Analog Actuators, 2 Units
#32- Hydronic Heat Pump Loop Control, 1 Stage Heat, 4 Stage Cooling, 2 Loop Pumps
#33- Chiller, 4 Stage Cooling, 2 Chill Water Pumps
#34- Not Currently Used
#35- Boiler, 4 Stage Heat, Outdoor Reset
#36- Boiler, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#37-39 Not Currently Used
#40- Air Handling Unit, 4 Stg Cool, 1 Stg Heat, Analog Cool, 3 Pt or Analog Economizer, Single Zone or VAV Server
#41- Air Handling Unit, Modulating Duct Static Pressure Control, Single Zone or VAV Server, 2 Units
#42- Air Handling Unit, Modulating Building Static Pressure Control, 2 Units
#43-49 Not Currently Used
#50- **VariZone®** Damper, 3 Point Floating or Analog Actuator
#51- **VariZone®** Damper, 3 Point Floating or Analog Actuator, 4 Zones
#52- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#53- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#54- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#55- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#56- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#57- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#58- Not Currently Used
#59- Modulating Heat, 3 Point Floating or Analog Actuator, 4 Zones
#60- VAV Dampers, Dual Duct System, 3 Point Floating or Analog Actuators, 2 Zones
#61-62 Not Currently Used
#63- Lighting Control, 8 Zones
#64- Reserved for Custom Output Definition