FULTON COUNTY PURCHASING DEPARTMENT

Winner 2000- 2005 Achievement of Excellence in Procurement Award
National Purchasing Institute

Jerome Noble, Director

April 12, 2006

RE: **ITB#06ITB49975K-DJ**
Jefferson Place Chiller & HVAC Upgrades

Dear Bidders:

Attached is one (1) copy of Addendum 1, hereby made a part of the above referenced Invitation to Bid (ITB).

Except as provided herein, all terms and conditions in the ITB referenced above remain unchanged and in full force and effect.

Sincerely,
Donna Jenkins

Donna Jenkins
Assistant Purchasing Agent

This Addendum forms a part of the contract documents and **modifies** the original ITB documents as noted below:

Under Division 15 Mechanical, section15950 has been included in the document.

ACKNOWLEDGEMENT OF ADDENDUM NO. 1

The undersigned proposer acknowledges receipt of this addendum by returning one (1) copy of this form with the proposal package to the Purchasing Department, Fulton County Public Safety Building, 130 Peachtree Street, Suite 1168, Atlanta, Georgia 30335 by the RFP due date and time **Wednesday, May 10, 2006, 11:00 A.M.**

This is to acknowledge receipt of Addendum No.1, _____ day of _____, 2006.

_____
Legal Name of Bidder

_____
Signature of Authorized Representative

_____
Title

ADDENDUM NUMBER ONE

1. Question: The above referenced project has DDC controls listed as an alternate price and section 15 950 listed in the index but I did not see 15 950 included in the documents.

   Response: Specification section 15 950 is issued with this addendum.

2. Item: Specification Section 01 030 Bid Alternates, item 3N. Bid Alternate No. 14 contains a typographical for the secondary hot water pumps.

   Response: Correct designation for Specification Section 01 030 Bid Alternates, item 3N. Bid Alternate No. 14 to read:
   "…Furnish and install new central DDC control system for the new skid mounted chiller package, existing chilled water pumps P-C1 and P-C2, existing hot water boiler, existing hot water primary and secondary pumps (P-B1 and P-B2), 3 new 4-pipe system…"

SECTION 15 950 - TEMPERATURE CONTROL SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section describes an automatic temperature control system for all HVAC equipment, new as well as existing, serving the entire building complex. The entire Section 15 950 applies to Bid Alternate No. 14 covered under Paragraph 3.N. of Specification Section 01 030.

A portion of this Section 15 950 would apply to work covered under base bid, consisting of, but not limited to, local DDC automatic temperature controls for new skid mounted chiller package, three new 4-pipe system air handling units and new chilled water and hot water DDC control valves for existing two groups of fan coil units located along north and south exposures of the First Floor Transitional Housing Wing. New chilled water and hot water DDC control valves shall be furnished and installed under scope of work covered by the base bid with provision of remote manual actuation (opening and closing) of the DDC control valves from a local control panel. Control schematic for the new chilled water and hot water DDC control valves is shown on Drawing M1.1. The control components for the base bid work shall be furnished and installed per this Section and sequences of operation of controls for each new piece of equipment installed under base bid work (skid mounted chiller package, three new 4-pipe system air handling units serving First Floor Transitional Housing Wing, First Floor Offices and Cafeteria) and for the existing two groups of fan coil units located along north and south exposures of the First Floor Transitional Housing Wing shall also be per this Section.

1.2 SUBMITTALS

A. Submit under provisions of Sections 01 310 and 15 010.

B. “Temperature Control system” and “Environmental Control System” phrases will be used throughout this Section and both shall have the same meaning.

C. The Temperature Control System (ECS) manufacturer/installer shall provide the following submittals prior to commencement of any work:

- System Architecture
- Well and tap schedule
- Sketches of all graphics
- Graphic representation tree showing all graphics and all points
- Detailed color conventions for graphics and points
- Software
- Sequences of operation
- Bill of material
- Hardware system diagrams
- Power and control wiring diagrams

- Point to point installation drawings
- Riser Diagrams
- Manufacturer's product data sheets

1.3 QUALITY ASSURANCE

A. Standards:

1. National Electrical Code
2. National Fire Protection Association Standards 72
3. National Fire Protection Association Standard 101 (Life Safety Code)
4. National Fire Protection Association Standard 90A (Air Conditioning Systems)
5. System must be U.L. Listed EF or EC or EF/EC Licensed.

B. All wiring and installation shall comply with NFPA 70. Recommendation by manufacturer's documentation for wiring requirements for shielding certain conductors from others or routing in separate raceways shall be followed, provided it does not violate NFPA 70.

C. ECS equipment to be of one manufacturer and be supported by a factory-trained, established service organization of equipment manufacturer who shall stock parts for equipment supplied.

D. Equipment shall be manufactured by a firm who has been actively manufacturing ECSs for a minimum of 15 years and includes a three year warranty on all control equipment.

E. The contractor directly responsible for this work shall be a Environmental Controls Systems contractor, who is and who has been regularly engaged in the furnishing and installation of commercial and industrial Integrated ECSs of this type and size for at least the immediate past five years. All equipment shall be installed by a technician trained by the equipment manufacturer or a recognized training school or course for the installations of this type system.

1.4 DESCRIPTION OF SYSTEM

A. Furnish and install a completely Integrated ECS in accordance with drawings, specifications and intent of the design. The ECS shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving. The system is intended to control the building's internal environment.

B. The ECS shall consist of the following:

Standalone DDC panels
Standalone application specific controllers (ASCs)
Personal computer operator workstation
Portable operator terminals

The system shall be modular in nature, and shall permit expansion of both capacity and

functionality through the addition of sensors, actuators, standalone application specific controllers, standalone DDC panels, and operator devices.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each control panel shall operate independently by performing its own specified control, alarm management, operator I/O and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

E. The design of the ECS shall network operator workstations and Standalone DDC panels. Inherent in the system's design shall be the ability to expand or modify the network either via the local area network, or auto-dial telephone line modem connections, or via a combination of the two networking schemes.

F. The system shall be complete in all respects and shall be installed by trained mechanics in the direct employ of the ECS equipment manufacturer who is to be responsible for the proper installation and operation of the control equipment. The ECS manufacturer shall furnish the services of an experienced engineer or superintendent to supervise the installation of the work and to insure job coordination.

G. All components not specifically indicated or specified, but necessary to make the system function within the intent of the specification, are to be included.

H. Size all control apparatus to properly supply and/or operate and control the apparatus served.

I. All electrical products shall be listed and labeled by UL and comply with NEMA Standards.

J. All electrical work required as an integral part of the ECS work is the responsibility of the ECS contractor, including but limited to control wiring, interlock wiring and ECS associated power wiring.

K. System shall be provided by Johnson Controls, ALC, or Staefa.

1.5 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The ECS contractor shall furnish complete maintenance and operation manuals per Section 01 730. The ECS Contractor shall instruct the Owner on the care, operation, and maintenance of all parts of the system per Sections 01 680 and 01 750.

B. Maintenance instructions shall include manufacturer's literature on all system equipment components. All maintenance instructions shall be explicit concerning time intervals for

all servicing and preventative maintenance, types and grades of oil and/or grease, packing materials, normal and abnormal clearance, methods of equipment adjustments, and a complete description of replacement parts and materials for wearing items.

1.6 OWNER'S INSTRUCTIONS

A. Upon completion of the work and acceptance by the Owner, the installing Contractor shall provide installation/operation information to the Owner's operating personnel who have responsibility for the ECS, per Section 01 750.

1.7 HARDWARE SUPPORT

A. The manufacturer of the ECS shall provide assistance in product applications and system trouble shooting. The materials and installation shall be guaranteed to be free of defects for one (1) year from date of beneficial use.

1.8 SYSTEM ACCEPTANCE

A. The ECS Contractor shall issue a report upon project completion stating that the system has been completed and adjusted, has had all hardware and software functions verified, and is operating in accordance with the specifications. Any deviations from specified settings or operations necessitated during system adjustment shall be specifically noted. A demonstration of complete system operation shall be made to the Owner's representative.

1.9 WARRANTY/MAINTENANCE

A. Warranty the temperature controls to maintain the temperature in rooms within one degree of the setting and further guarantee all work, materials equipment, and controls against defects in workmanship and material and provide service for a period of one (1) year from date of final acceptance.

B. Replace any defective workmanship or material developing within that time as soon as possible at no charge to the Owner.

C. After completion of the installation, the ECS contractor shall regulate and adjust all thermostats, control valves, control motors, smoke detectors and other equipment provided in this contract.

PART 2 PRODUCTS

2.1 STANDALONE DDC PANELS

A. General

Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies,

and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification. Each controller shall have 20% spare analog and binary points for future use.

B. Memory

Each DDC panel shall have sufficient memory to support its own operating system and databases including:

Control Processes
Energy Management Applications
Alarm Management
Historical/Trend Data for all points
Maintenance Support Applications
Custom Processes
Operator I/O
Dial-Up Communications
Manual Override Monitoring

C. Point Types

Each DDC panel shall support the following types of point inputs and outputs:

- Digital inputs for status/alarm contacts
- Digital outputs for on/off equipment control
- Analog inputs for temperature, pressure, humidity, flow, and position measurements
- Analog outputs for valve and damper position control, and capacity control of primary equipment
- Pulse inputs for pulsed contact monitoring

D. Expandability

The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators.

The system architecture shall support 25% expansion capacity of all types of DDC panels, and all point types included in the initial installation.

E. Serial Communication Port

Standalone DDC panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator devices such as industry standard printers, laptop workstations, PC workstations, and panel mounted or portable DDC panel operator terminals. Standalone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

F. Hardware Override Switches

As indicated in the point schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard hand/off/auto operator override switches for binary control points and gradual switches for analog control type points.

All points that are scheduled to have hand/off/auto switches shall be monitored by the DDC controller. The switch override position shall be included in logs and summaries to inform the operator that automatic control has been inhibited.

G. Integrated On-Line Diagnostics

Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each DDC panel, and shall not require the connection of an operator I/O device.

H. Powerfail Restart

In the event of the loss of normal power, there shall be an orderly shutdown of all standalone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

2.2 OPERATOR DEVICES

A. PC Operator Workstation

A Personal Computer Operator Workstation shall be provided in Building Maintenance Engineer's Office in Basement for command entry, information management, network alarm management, and database management functions.

Workstation shall be general purpose, commercially available, personal computer with sufficient memory and processor capacity to perform all functions described in this specification.

Sufficient bulk storage shall also be provided to accommodate all fully configured point data bases, all application databases, all graphics data bases, all user-defined reports, and all Historical Data archives as described below.

1. Host Computer: IBM Compatible with 350 gigabyte (GB) hard disk, 512 MB random access memory (RAM), Intel Pentium processor with 3 GHZ clock speed, 21 inch SVGA flat screen color monitor (0.1 mm dot pitch) and graphics card with 8 MB

video RAM and 32 bit local bus, one CD drive, one (1) 3.5 inch drive, one high speed fax/modem, two (2) parallel and two (2) synchronous serial ports. The computer shall have a battery powered un-interruptible real time clock. The real time clock shall provide the following information: time-of-day, month, year, and day-of-week.

2. Mouse: The primary operator interface device shall be a 2-button Microsoft bus mouse.
3. Keyboard: Provide an enhanced 101-key keyboard with a full ASCII complement, separated from the CPU with a coiled cord. The keyboard shall include a dedicated numeric keypad with separate ENTER key for rapid entry of data and a minimum of ten special programmable function keys for single keystroke entry of commonly used operator commands.
4. Printers: The contractor shall provide an alarm and report printer as a part of the central site. The printer(s) shall be a tabletop units with sprocket pin-feed tractors to use wide fan fold 17" x 11" paper. This printer shall be capable of graphics and at least 800 characters per second for data print and be able to provide near letter quality print. Printer shall use parallel ports, have 132 (min) character page width, and use a 96 standard ASCII or IBM character set as a minimum.

B. Standalone DDC Panel, Local or Portable Operator Terminals

1. Each DDC panel shall be capable of supporting a permanent or portable operator terminal as described earlier. When the portable operator terminal is plugged into the DDC panel, no loss of central workstation point monitoring or control shall occur.
2. The minimal operator functions provided by the Local or Portable operator terminal shall include the following:

   - Start and Stop Points
   - Modify Set Points
   - Modify PID Loop Set Points
   - Override PID Control
   - Change Time/Date
   - Add/Modify Start/Stop Weekly Scheduling
   - Add/Modify Set Point Weekly Scheduling
   - Enter Temporary Override Schedules
   - Define Holiday Schedules
   - View Analog Limits
   - Enter/Modify Analog Warning Limits
   - Enter/Modify Analog Alarm Limits
   - Enter/Modify Analog Differentials
   - View Point History Files

3. The DDC panel operator terminal shall provide access to all real or calculated points in the controller to which it is connected or any other controller in the network.
4. Operator access procedures at Local or Portable operator terminals shall be identical to each other, as well as identical to that at the PC Operator workstations.
5. The Local or Portable operator terminal shall provide English language prompting

to eliminate the need for the user to remember command formats or point names. Prompting shall be provided consistent with a user's password clearance and the types of points being displayed, to eliminate the possibility of operator error.

6. Identification for all real or calculated points shall be consistent for all network devices. The same English language names used at PC workstations shall be used to access points at the Local or Portable operator terminal to eliminate cross-reference or look-up tables.
7. In addition to instantaneous summaries, the Local or Portable operator terminal shall allow a user to view a Point History file for system points. Point History files shall provide a record of value of analog points over the last 24 hours, at 30-minute intervals, or a record of the last ten status changes for binary type points.
8. The contractor shall provide one full function portable operator terminal to the Owner prior to final system testing.

2.3 APPLICATION SPECIFIC CONTROLLER - HVAC APPLICATIONS

A. General

1. Each Standalone DDC Controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

    a. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
    b. Each ASC shall have sufficient memory to support its own operating system and data bases including:

        - Control Processes
        - Energy Management Applications
        - Operator I/O (Laptop Computer)

    c. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or any PC or portable operator's terminal connected to any DDC panel in the network or local I/O devices (LED's Switches etc.) where described and provided.
    d. Application Specific Controllers shall directly support the use of a portable operator's terminal, providing the following:

        (1) Display temperatures
        (2) Display status
        (3) Display set points
        (4) Display control parameters
        (5) Override binary output control
        (6) Override analog set points
        (7) Modification of gain and offset constraints

    e. Power Fail Protection: All system set points, proportional bands, control algorithms, and any other programmable parameters shall be stored such

that a power failure of any duration does not necessitate reprogramming the controller.

B. Controllers

1. Air Handling Unit and Fan Coil Unit Controllers

a. Air Handling Unit (AHU) and Fan Coil Unit (FCU) Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.
b. AHU and FCU Controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the Execution portion of the specification.
c. Hardware Override Switches: The operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard hand/off/auto operator override switches for binary control points and gradual switches for analog control type points. These override switches shall be operable whether the panel is powered or not.
d. Hardware Override Monitoring: DDC panels shall monitor the status or position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.
e. Continuous Zone Temperature Histories: Each AHU and FCU shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
f. Alarm Management: Each AHU and FCU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2. Central Plant Controllers

a. Central Plant controllers shall support, but not be limited to, the following configurations of systems to address current requirements described in the "Execution" portion of this specification, and for future expansion.

Chiller plant with pump logic
Hot Water Heating plant
Air Handling Units and Fan Coil Units with complex control sequences
Plant Heating and Cooling circuits

b. Central Plant controllers shall support all the inputs and outputs to perform the specified control sequences in a totally standalone fashion.
c. Central Plant controllers shall have a built-in status and adjust panel interface to allow for the local adjustment of all set points, temporary override of input or output points and status of points in alarm.

3. System Integration Controllers

   a. General:

      (1) The ECS shall interoperate with multiple building systems supplied by different manufacturers. The ECS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, power monitoring systems, and fire alarm.

      Point inputs and outputs from the third-party controllers shall have real-time interoperability with ECS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Dial-Up and Local Area Network Communications.

      (2) The ECS shall support any combination of third-party controllers on a single network. A minimum of 100 third-party controllers shall be supported on a single network. Integration shall be by RS-232 or RS-485 technologies.
      (3) The installer/operator shall have the ability to verify, and diagnose communication messages and point information between third-party controllers and the ECS.

   b. Skid Mounted Chiller Package:

      (1) The start of any air handler shall start the central chiller plant. The ECS shall give a start signal to the Manufacturer's Chiller Control/Translator-Interface Panel, via RS-232/RS-485 communication (open protocol).
      (2) Chiller control panel and Translator-Interface Panel will be provided by the chiller manufacturer.
      (3) Panel shall soft start the chiller. Start ramp shall be adjustable.
      (4) Panel shall load/unload the chiller to provide 44 deg. F. chilled water supply temperature (ajustable through the ECS).
      (5) When power is interrupted, the panel shall recycle to a normal start sequence.
      (6) The Chiller Manufacturer will provide a Translator/Interface panel compatible with its chiller which shall interface with the ECS and provide the following monitoring and commandable points to the ECS, as a minimum:

      Monitoring:

      Leaving chilled water temperature-each chiller
      Entering chilled water temperature-each chiller
      Evaporator Saturation Temperature
      Condenser Saturation Temperature
      Discharge Temperature
      Oil Temperature
      Evaporator Pressure

Condenser Pressure
Oil Differential Pressure
Purge (if applicable) Pressure
Full Load Amps
Phase A Amps
Phase B Amps
Phase C Amps
Phase AB Volts
Phase BC Volts
Phase CA Volts
Low Oil Pressure
High Oil Pressure
Leaving Water Temperature Actual Set Point
Current Actual Set Point Feedback
Compressor Run Status
Vent Solenoid Status
Chilled Water Pump Status
Start Switch Status
Flow Switch Status in Chilled Water Loop

Commandable:

Current Limit Set Point
Leaving chilled water temperature set point
Chiller start/stop

c. Hot Water Heating Boilers:

(1) The start of any air handler shall start the central hot water heating plant. The ECS shall give a start signal to the Manufacturer's Boiler Control/Translator-Interface Panel, via RS-232/RS-485 communication (open protocol).
(2) Heating hot water boiler control panel and Translator-Interface Panel shall be provided under scope of this section, if one is not existing.
(3) Panel shall load/unload the heating hot water boiler to provide 180 deg. F. hot water supply temperature (ajustable through the ECS).
(4) When power is interrupted, the panel shall recycle to a normal start sequence.
(7) Translator/Interface panel shall be compatible with heating hot water boilers which shall interface with the ECS and provide the following monitoring and commandable points to the ECS, as a minimum:

Monitoring:

Leaving hot water temperature-each boiler
Entering hot water temperature-each boiler
Leaving Water Temperature Actual Set Point
Current Actual Set Point Feedback
Boiler Run Status

Hot Water Pump Status
Start Switch Status

Commandable:

Leaving hot water temperature set point
Boiler start/stop

2.4 DIRECT DIGITAL CONTROL SOFTWARE

A. General:

1. The DDC panels shall be totally preprogrammed and verified as satisfying the requirements of the Sequence of Operation. However, it shall be possible to reprogram the panels on site either by the control contractor or the Owner. The software programs specified in this section shall be provided as an integral part of the DDC panel and shall not be dependent upon any higher level computer for execution.
2. The DDC panel shall be configured to perform all control and Energy Management routines either as a distributed processing unit to a Central Monitoring and Control System or as a stand-alone unit. The system shall be configured to automatically transfer to the stand-alone mode without operator intervention.

B. Resident Library Routines

1. The DDC panel shall provide a complete library of HVAC tailored library routines to be used in the creation of the sequences of control . It shall not be necessary for the user to create these programs for BASIC or similar programming languages.

C. Applications Programs

1. General

a. Provide all hardware and software to implement the application features indicated in the sequence of operations for each piece of scheduled equipment. If sensors or inputs that may be required for proper operation are not specifically indicated to be provided, provide all necessary inputs to the DDC panel to accomplish the indicated applications programs.

2. Demand Limiting:

a. Provide software to limit excess utility charges caused by uncontrolled demand. Actions taken by this program will be as necessary to limit peak power demand. Typical actions may be to reset chiller load limiter or cycle off equipment that is available to be turned off. It shall be possible to prioritize the actions to be taken in a minimum of 4 levels. The demand limiting program shall receive its input from a contact closure pulse provided at the incoming power meter.

3. Morning Warm Up

    a. Provide a program for each air handling system that utilizes outside air, that will not allow the outside air dampers to be operated until the return air temperature reaches a predefined value, or until occupancy time (at which time the damper will go to a minimum position to provide for ventilation until return air requirements are satisfied).

4. Night Setback

    a. Provide a program to lower the heating space temperature set point or raise the cooling space temperature set point during unoccupied periods. The program shall close the outside air dampers when the equipment operates during the unoccupied periods.

5. Password

    a. Provide a software program at the DDC panel designed to restrict access to the functions via a password. The password shall be an alpha numeric code. In order for any adjustments to be made, the password must first be entered. A minimum of 50 passwords shall be supported at each DDC panel.

6. Time of Day Scheduling

    a. Provide programs for multiple start and stop times for each major piece of equipment on any given day. The program shall not be limited to number of starts or stops per day, and shall provide positive feedback status of equipment.

7. Holiday Scheduling

    a. Provide a predefined holiday program template. Holiday programming shall be provided by filling in a block on a calendar board.

8. System Restart

    a. Provide a program based on the detection of a power failure to restart the DDC panel operation. Upon restoration of the AC power to the panel, automatically restart all equipment and restore all loads to the state at the time of the power failure or to the state as required by the time programs. Provide appropriate time delays to prevent demand surges or overload trips.

9. Time Programs

    a. Time programs shall be provided that shall automatically be initiated based upon pre-established time schedules for those items specified. Provide capacity for four sets of on and off times for each day of the week (Monday through Sunday). The program shall monitor the controlled equipment or

event to verify that the command has been carried out and provide a visual alarm at the NT when the equipment does not start or stop, fails, or is locally started to stopped. The time program shall operate in conjunction with, and be coordinated with, optimum start/stop, duty cycle, demand limiting, and night setback programs.

10. Event Programs

    a. Provide an event program that can be activated based on changes in field conditions, manual commands, or other application program outputs. These event programs shall be capable of either a binary output (on/off) or analog output as well as changes to other program parameters (modify set point, modify duty cycle period, etc.).

11. Optimum Start/Stop Program

    a. Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions. The program shall automatically evaluate the thermal inertia of the structure, the capacity of the HVAC system to either increase or reduce space temperatures, and indoor and outdoor conditions to determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. Provide a target space temperature set point as well as occupancy and vacancy times that are changeable from the NT. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.

12. Equipment Cycling Protection

    a. Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

13. Heavy Equipment Delays

    a. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

D. Alarm Management

1. Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC workstation or local I/O device, or communications with other panels on the network.

a. Point Change Report Description

1. All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.

b. Prioritization

1. The user shall be able to define the specific system reaction (i.e., OWS alarm display, etc.) for each point. Alarms shall be prioritized to enhance operator response to critical alarms. A minimum of three priority levels shall be provided.

c. Report Routing

1. Alarm reports, messages, and files will be directed to user-defined operator devices, or PC(s) used for archiving alarm information. Alarms shall also be automatically directed to a default device when the primary device is off-line.

d. Alarm Messages

1. In addition to the point's description and the time and date, the user shall be able to print, display or store a 65-character alarm message to more fully describe the alarm condition or direct operator response.

e. Auto-Dial Alarm Management

1. In dial-up applications, user defined alarms shall initiate a call to a remote operator device. The alarm buffer must also store a minimum of 50 alarms.

E. Historical Data and Trend Analysis

1. A variety of Historical Data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways,

a. Continuous Point Histories

1. Standalone DDC panels shall store continuous Point History Files for those analog inputs and binary inputs and outputs called for in this specification.
2. The Point History routine shall continuously and automatically sample the value of selected analog inputs at half hour intervals. Samples shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output points shall include a continuous record of the last ten status changes or commands for each point.

b. Extended Sample Period Trends

1. Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting data over extended periods of time. Minimum sample intervals of 1 minute to 2 hours shall be provided. Each standalone DDC panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 5000 data samples.

c. Data Storage and Archiving

1. Trend data shall be stored at the standalone DDC panels, and up-loaded to hard disk storage when archival is desired. Uploads shall occur based upon either user defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file form for use in third party personal computer applications.

F. Runtime Totalization

1. Standalone DDC panels shall automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.
2. The totalization routine shall have a sampling resolution of one minute or less.
3. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

G. Analog/Pulse Totalization

1. Standalone DDC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
2. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., KWH, Gallons, KBTU, Tons, etc.).
3. The totalization routine shall have a sampling resolution of one minute or less.
4. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

H. Event Totalization

1. Standalone DDC panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.
2. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.5 FIELD SENSORS AND DEVICES

A. Analog Input Devices

1. Resistor Temperature Detector (RTD): RTD's shall have a range of minus 50 to plus 250 degrees F, with a resistance tolerance of .25% at 70 degrees F. The RTD shall be encapsulated in epoxy, series 300 stainless steel, or nickel elements with a temperature coefficient of three ohms per degree. The RTD's shall be provided for mounting in a separable well for liquid sensing applications.

    a. Provide averaging sensor for all supply, return and mixed air duct applications.
    b. Provide wall mounted sensors with lockable covers for all room sensing applications. Include all necessary wall and back boxes required for the required application.
    c. Provide outside air sensors within a liquid tight conduit enclosure. Provide a sun shield with each sensor.

2. Humidity Sensors: Provide a solid state humidity sensor with a range of 10 to 80 percent relative humidity with an accuracy of plus or minus 4% at 70 degrees F. The sensing element shall be of the non saturating type. Provide either duct or wall mounted versions based on the application required.
3. Differential Pressure Transmitters: Provide electronic static pressure transmitters for the appropriate ranges as indicated on the plans or in the specifications. The device shall provide for ranges of from 0 to .1 inches of water column up to 0 to 10 inches of water column. Accuracy at any range shall be plus or minus 2 percent full scale. Units shall be rated for ten times normal input pressure.
4. Duct Smoke Detectors: Air duct smoke detectors shall be photoelectric type and analog addressable. The detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The detector shall operate at air velocities of 300 feet per minute to 3000 feet per minute. Shall be 2-wire Class B supervisory configuration. The detector housing shall be equipped with an integral mounting base capable of accommodating either photoelectric or ionization detector heads. The duct detector housing shall be molded NORYL plastic and shall incorporate an airtight smoke chamber. Standard for smoke detectors for duct applications. The housing shall be capable of mounting to either rectangular or round ducts without adapter brackets. An integral filter system shall be included to reduce dust and residue effects on detector and housing, thereby reducing maintenance and servicing. Sampling tubes shall be provided extending through the entire width of the duct. Terminal connections shall be of the strip and clamp method suitable for 14-18 AWG wiring. Wiring shall be connected to a terminal strip and be so noted and numbered.
5. Heat Detectors: Heat detectors shall be analog addressable type. Detectors shall indicate an alarm condition at 140 deg. F. or if the rate of temperature rise exceeds 15 deg. F. per minute. Detectors shall positively indicate an alarm condition via dual LED's on the sensor.

B. Binary Input Devices

1. Differential Pressure Switches: Provide a differential pressure switch with single pole double throw contacts. Switch operation shall be adjustable over the

operating range. The switch shall have a snap-acting Form C contact rated for the application. The switch contacts shall be rated for 5 amps at 120 volts as a minimum.

C. Output Devices

1. Control Relays: Control relay contacts shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dustproof enclosure. Relays shall have silver alloy contact material. Relay operation shall be in 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression (limiting transients to nondamaging levels). All control relays shall be of the plug-in style with a separate base. All wiring shall be terminated to the base and not the relay itself.
2. Air Handling System Shutdown Relays: Provide and install a supervised addressable output relay at each Air Handling System for shutdown on alarm from fire alarm panel as per system operation description. The unit shall be normally closed with a coil to match voltage of Fire Alarm Control Panel and interrupt starting circuit of Air Handling System unit fan(s).
3. Electric Resistance Transducer (ERT): The ERT shall be compatible with the 4-20 MA signal from the DDC panel. The ERT shall provide a resistance change proportional to the input signal. the resistance range shall be matched to the specific application.

2.6 DAMPERS

A. Control Dampers

1. The control contractor shall furnish all control dampers as shown on the plans and/or as required to perform the control sequence specified except those furnished with fan equipment. All modulating dampers shall be sized by the control contractor to meet flow requirements of the application in accordance with his recommendation. All two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than 90% of duct area.
2. Unless otherwise indicated. All control dampers shall be opposed blade type. Two position dampers may be parallel blade type.
3. All dampers shall be factory fabricated and shall be standard products of the control manufacturer.
4. Damper frames shall not be less than 16 gauge galvanized steel or extruded aluminum of 12 gauge. Blades shall not be less than 14 gauge galvanized steel or 14 gauge aluminum, not over 8 inches in width with steel trunions mounted in a bronze sleeve, nylon or ball bearings.
5. All blade linkage hardware shall have corrosion-resistant finish and be readily accessible for maintenance. Furnish dampers with replaceable neoprene or felt edging seals installed at all four sides of the frame and each blade.
6. Dampers and seals shall be suitable for maximum temperature and air velocities to be encountered in the system with minimum temperature range of -40 degrees F to 200 degrees F. Submit leakage and flow characteristic data for all control dampers along with shop drawings. Dampers, when closed, shall be guaranteed by the control manufacturer not to leak air in excess of 1/10% per AMCA standard 500.

Dampers shall be Johnson Controls D-1300 or Ruskin CD60.

B. Damper Operators

1. Damper operators shall be provided for each automatic damper and shall be of sufficient capacity to operate the damper under all conditions. Each operator shall be full-proportioning or two-position type as required, indicated or specified, and shall be provided with spring return for normally closed or normally open position for fire, freeze, or moisture protection on power interruption as indicated and/or as required. Provide pilot positioners where necessary to achieve proper control.
2. Provide operators with proper linkages and brackets for mounting and attaching to devices.

2.7 VALVES

A. General

1. The control contractor shall furnish all control valves as shown on the plans and/or as specified to perform the control sequence specified.
2. Valves 2" and smaller shall have bronze body with screwed ends; valves 2-1/2" and larger shall have cast iron body with flanged ends. Nominal body rating shall not be less than 125 psig. However, the valve body and packing selected shall be designed to withstand the maximum pressure and temperature encountered in the system.
3. Valves shall have stainless steel stems, spring-loaded teflon packing, replaceable seats and discs.
4. Where sequencing of valves is called for, such sequencing shall be accomplished by spring ranged adequate for the applications to avoid overlap of operation and simultaneous use of heating and cooling.
5. Water Valves:

   a. Furnish all modulating straight-through water valves with equal-percentage contoured throttling plugs. Furnish all three-way valves with linear throttling plugs such that the total flow through the valve shall remain constant regardless of the valve's position.
   b. Contractor shall be responsible for selection of proper control valves for the project including line size, pressure rating, temperature ratings, flow coefficient, shutoff ratings and allowable leakage factor. All valves installed for two position operation shall be line size. Modulating water valves shall be sized for nominal four (4) psi maximum pressure drop.

B. Valve Operator

1. Valve operator shall be provided for each automatic valve and shall be of sufficient capacity to operate the valve under all conditions, and to guarantee tight close-off of valves, as specified, against system temperatures and pressure encountered. Each operator shall be full-proportioning or two-position type as required, indicated or specified, and shall be provided with spring return for normally closed or normally open position for fire, freeze, or moisture protection on power interruption

as indicated and/or as required. Provide pilot positioners where necessary to achieve proper control.

2. Provide operators with proper linkages and brackets for mounting and attaching to devices.

2.8 POWER SUPPLIES

A. DC Power Supplies:

1. Provide a regulated 24 volts dc power supply for each of the DDC panels to provide for the control voltage necessary to control the output relays, EPT's, and other output devices. The power supply shall operate from 120 VAC and contain internal over voltage and over current protection as a part of the unit. The power supply shall be capable of delivering a minimum of 3 mA of current.

B. Transformers:

1. Provide transformers where 24 volts ac is required for the ECS. Transformers shall be provided with internal surge suppressors, to limit equipment damage due to induced high voltages.

2.9 ADDITIONAL CONTROL SYSTEM EQUIPMENT

A. DUCT HUMIDISTATS: Humidistats for duct mounting shall include a duct sampling tube and chamber both as a means of sampling air within a duct to provide proper humidity control. The sampling tube shall have a minimum insertion length of 12 inches, and shall be designed to force air into the chamber box and circulate around the humidistat, and be discharged through a slot on the downstream side of the sampling tube.

B. REMOTE BULB OR IMMERSION THERMOSTATS: Shall be line voltage type with single pole, single throw switching. Switches shall have an adequate rating for the applied load.

C. FREEZE STATS (LOW-LIMIT CUT-OFF)

1. Freeze stats shall be of the electric 2-position type with temperature sensing element and manual reset. Stats shall be capable of opening the stat circuit if any one foot length of the sensing element is subject to a temperature below the state setting.
2. Sensing element shall not be less than one lineal foot per square foot or coil surface areas. Unless otherwise indicated, set freeze stats at 40 degrees F.

D. FIRESTATS (FAN SAFETY CUT-OFF)

1. Fire stats shall be manual reset, line voltage type with bimetal actuated switches. Set stats to stop unit fans if the air temperature exceeds 135 degrees F.

E. AQUASTATS

1. Aqua stats shall be line voltage type with single pole, single throw switching. Switches shall have an adequate rating for the applied load.

2.10 CONTROL CABINETS

A. All controllers, switches, pressure gauges and other equipment furnished as part of the control system which are not required to be mounted on equipment, shall be cabinet mounted. All wiring and piping connections shall be made inside the cabinet. All electrical devices shall be wired to a numbered terminal strip.

PART 3 EXECUTION

3.1 GENERAL

A. Install all ECS equipment and wiring in a neat and workmanlike manner to the satisfaction of the Architect and/or Engineer.

B. All immersion wells, pressure tappings and any associated shutoff cocks, flow switches, level switches and other such items furnished by the ECS manufacturer will be installed by the mechanical contractor under the coordinating control and supervision of the ECS contractor.

C. Install all control devices in an accessible location.

D. Provide, install, calibrate and demonstrate to the owner a complete and functioning ECS per the specified sequence of operations.

E. All wiring required for a full and functioning ECS per the sequence of operations is work of this section.

F. All control panels shall be provided and installed where shown on plans or within specifications. All control panels shall be powered by the ECS manufacturer/installer. The ECS contractor is to provide ample power wiring to power all panels from the power circuits or junction boxes shown on the Electrical Drawings.

G. All terminations made within the ECS manufacturer/ installers panels shall be verified and tested prior to final powering of panel. Control devices from other systems shall not be temporarily or permanently mounted with in the control panel.

3.2 ELECTRICAL WIRING

A. All electrical wiring for the ECS, including power circuit to control panels, both line and low voltage unless otherwise indicated, shall be furnished and installed by the ECS contractor in accordance with all the electrical sections of this specification and all applicable electrical codes.

3.3 ELECTRICAL WORK

A. Control Wiring: Control wiring, including electrical interlock wiring, shall be provided as

a part of this specification section. Run all control wiring separate from power wiring, also do not utilize the same conduit for analog sensor wiring and any wiring carrying an AC current. Install wiring in accordance with the National Electric Code, Section 725, Division 16 specifications and applicable local codes. All wire and wiring devices used shall be certified by the ECS contractor. All control wiring in exposed areas or located outdoors shall be run in metal conduit. Plenum rated cable may be used if located above a drop ceiling or other accessible finished space.

B. Power Wiring: Power wiring to all control panels and devices shall be provided as part of this work and shall be extended from the power circuits or junction boxes shown on the Electrical Drawings. Power circuits to control panels shall not be shared with any other electrical equipment. Power wiring required by the ECS manufacturer/installer for electric end devices (eg: actuators, relays, etc.) is work of this section. All power wiring shall be run in metal conduit. All conduit, wire, hangers, etc. associated with wiring to end devices is work of this section.

C. Indoor conduit shall be EMT, a minimum of 3/4" in diameter. Steel compression fitting shall be used to join EMT with electrical boxes, cabinets and panels.

D. Outdoor conduit shall be rigid galvanized type, a minimum of 3/4" in diameter. Fittings shall be threaded type with watertight joints.

3.4 TESTING

A. The contractor shall perform all electrical and mechanical tests required by the equipment manufacturer's form and National Fire Protection Association 72 and NFPA 72H. In addition, he shall measure, adjust and clean each type of detector to the maximum stable sensitivity setting. This must be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. All test and report costs shall be in the contract price. A checkout report shall be prepared for each system (building) by the installation technicians and submitted in triplicate, one copy of which will be registered with the equipment manufacturer.

3.5 DOCUMENTATION

A. After completion of all the tests and adjustments listed above, the contractor shall submit record documents per Sections 01 720.

3.6 FINAL TESTS AND INSPECTION

A. Final tests and inspection shall be held in the presence of the Owner's personnel, or their representatives, in accordance to Section 01 750. The contractor shall supply personnel and required auxiliary equipment for this test without additional cost.

3.7 WORK BY OTHERS

A. All valves and dampers shall be installed by the mechanical contractor. All pipe and duct penetrations shall be provided by the mechanical contractor, or his designated

subcontractor.

3.8 DAMPERS

A. All dampers furnished by the ECS manufacturer shall be installed by the mechanical contractor under the coordinating control and supervision of the ECS contractor.

B. Any necessary blank-off plates or transitions required to facilitate the standard size dampers shall be provided by the mechanical contractor. In areas where the damper is 70% or more of the duct area, blank-off plates are to be used. In areas where the damper is less than 70% of the duct area, a transition shall be provided.

3.9 VALVES

A. All temperature control valves, furnished by the ECS manufacturer shall be installed by the mechanical contractor under the coordinating control and supervision of the ECS contractor.

3.10 FREEZE STATS

A. Install freeze stats in all air handling units. Unless otherwise indicated, install sensing element at the downstream side of heating coils.

B. Distribute sensing element across the entire area of the medium being sensed. Install stats at accessible locations with suitable mounting brackets and element duct collars where required.

3.11 ROOM THERMOSTATS/TEMPERATURE SENSORS

A. Install all room thermostats/temperature sensors where indicated or directed to meet job site conditions.

1. Mount all thermostats/temperature sensors per ADA requirements.
2. Any room thermostats/temperature sensors mounted on exterior walls shall be mounted on thermally insulated sub-base.
3. Relocate room thermostats/temperature sensors if required due to draft, interferences with cabinets, chalkboards, etc., or improper sensing.

3.12 MANUFACTURER'S/SUPPLIER'S CERTIFICATE

A. A letter/certificate addressed to the owner, signed by the control supplier's representative certifying that the temperature control system has been installed in accordance with the contract documents and control shop drawings and is operating properly shall be submitted prior to final inspection.

3.13 CONTROL SEQUENCE

Systems shall perform in accordance with the following:

A. AIR HANDLING UNITS, ROOF TOP (AIR HANDLING) UNITS and HEATING AND VENTILATING UNITS:

1. The units shall be started and stopped by the central ECS through an optimal start/stop program.
2. The system operator shall be provided with the capability to manually command a unit on and off from the operator workstation located in the building maintenance engineer's office or through a portable hand held service terminal.
3. All associated automatic dampers shall open and outside air supply fan, if applicable, shall start prior to the start of the fan system.
4. A differential pressure switch piped across the supply fan shall indicate the unit has been started and shall allow the temperature control sequence to operate.
5. Differential pressure switches piped across the filter banks shall provide a service advisory to the operator in the event that the differential pressure increases above a predetermined (adjustable) set point.
6. A room thermostat, through the direct digital controller, shall modulate the chilled water control valve in cooling season (for air handling units and roof top units only) and hot water control valve in heating season to maintain a predetermined (adjustable) room temperature set point. Provide separate outputs for the cooling and heating. Cooling and heating coils shall be provided with 2 way control valves. All associated valves shall close to the coil upon unit shut down.
8. Provide software and all necessary overrides to provide a morning warm-up sequence. Outside air damper shall remain closed and outside air supply fan, if applicable, shall remain off during warm-up.
9. A freeze stat located downstream of the heating coil shall shut down the unit upon activation and open hot water control valve to the heating coil.
10. Duct smoke detectors mounted in the supply and return air stream of the air handling units, roof top units and heating and ventilating units, shall initiate a fire alarm signal to the fire alarm control panel for smoke control initiation. This contractor shall provide and mount all duct smoke detectors. The air handling units, roof top units and heating and ventilating units shall shut down upon activation.
11. Upon loss of communication with ECS the Standalone controller shall operate in occupied mode.

B. CHILLED WATER SYSTEM

1. The operating chilled water pump shall be started and stopped through the central ECS when any air handling unit and/or any other chilled water consuming device is started.
2. When the chilled water pump is started, the chiller package isolation valve shall open, evaporative condenser fans and evaporative condenser water recirculation pump(s) shall be enabled and solenoid valve in service water makeup piping for evaporative condensers of the skid mounted chiller package opened. When the chiller package is de-energized, the isolation valve shall close.
3. A differential pressure switch piped across each pump shall provide the system operator with positive run indication. Upon pump failure, pump failure alarm shall be annunciated and the stand-by pump, where available, shall be energized. The existing two chilled water pumps P-C1 and P-C2 shall be alternately run

automatically based upon run time.

4. Once the chiller package has been enabled and flow has been proven, the operation of the chiller package (its component rotary screw refrigeration compressors, evaporative condensers, evaporative condenser water recirculation pumps) shall be automatically controlled or cycled, as appropriate, under its own controls and safeties depending on the load condition. Upon failure of any component of chiller package (refrigeration compressor, evaporative condenser fan, evaporative condenser water recirculation pump, etc.), chiller failure alarm shall be annunciated and the corresponding non-operating component of the chiller package (refrigeration compressor, evaporative condenser fan, evaporative condenser water recirculation pump, etc.), if available, shall be energized.
5. Head pressure in the skid mounted chiller package will be maintained by its factory installed control panel.
6. Controls contractor shall be responsible for installing and connecting all chiller controllers and indicators that are not factory installed and wired by the chiller manufacturer. The above shall include all work on the chiller control panel as required for specified chiller.

C. HOT WATER SYSTEM

1. Hot water boilers and hot water primary and secondary pumps are existing. The operating hot water primary and secondary pumps shall be started and stopped through the central ECS when any air handling unit and/or any other hot water consuming device is started.
2. When the hot water pump is started, the hot isolation valve shall open and hot water boiler burner controls shall be enabled. When the boiler(s) is(are) de-energized, the respective isolation valve(s) shall close.
3. A differential pressure switch piped across each pump shall provide the system operator with positive run indication. Upon pump failure, pump failure alarm shall be annunciated and the stand-by pump, where available, shall be energized. The two secondary hot water pumps P-B1 and P-B2 shall be alternately run automatically based upon run time.
4. Once a boiler has been enabled and flow has been proven, the boiler shall be automatically cycled under its own controls and safeties depending on the load condition. Upon boiler failure, boiler failure alarm shall be annunciated and the non-operating boiler, if available, shall be energized. The two boilers shall be alternately run automatically based upon run time.
5. Controls contractor shall be responsible for installing and connecting all boiler controllers and indicators that are not factory installed and wired by the boiler manufacturer. The above shall include all work on the boiler control panel as required for specified boiler.

D. FAN COIL UNITS

1. Fan coil units in the building complex are existing, located in the Transitional Housing Wing, have a single coil and are piped for 2-pipe system. Separate chilled water and hot water supply and return branch piping connections will be extended to groups of the fan coil units located along north and south exposure of the Transitional Housing Wing.

2. Controls contractor shall furnish and install two way DDC electric control valves for the groups of the fan coil units located along north and south exposure of the Transitional Housing Wing. Chilled and hot water control schematic for each group of the fan coil units is shown on Drawing M1.1.
3. The operation of the control valves for the groups of the fan coil units located along north and south exposure of the Transitional Housing Wing shall be controlled by an outdoor air stat. Rising outdoor air temperature in spring above 60˚F shall automatically generate control signal to close and disable the two way control valves in hot water supply and return branch piping and enable and open the two way control valves in chilled water supply and return branch piping thus allowing chilled water to flow through the group of the fan coil units for allowing them to operate under cooling mode of operation. Similarly, falling outdoor temperature in fall below 55˚F shall automatically generate control signal to close and disable the two way control valves in chilled water supply and return branch piping and enable and open the two way control valves in hot water supply and return branch piping thus allowing hot water to flow through the group of the fan coil units for allowing them to operate under heating mode of operation.
4. A room thermostat, through the direct digital controller, shall modulate the chilled water control valve in cooling season and hot water control valve in heating season to maintain a predetermined (adjustable) room temperature set point of 76˚F in summer and 72˚F in winter. Provide separate outputs for cooling and heating. All associated automatic valves shall close to the coil upon unit shut down under cooling mode of operation and open to the coil upon unit shut down under heating mode of operation.
5. Provide software and all necessary overrides to provide a morning warm-up sequence. Outside air damper shall remain closed during warm-up.
6. A freeze stat located downstream of the coil, if present, shall shut down the unit upon activation.
7. Upon loss of communication with ECS the Standalone controller for the fan coil units shall operate in occupied mode.

E. FANS

1. Building toilet exhaust fans shall be started and stopped by the central ECS based on building daily operating schedule.

END OF SECTION 15950