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S H E E T

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 Dodge Plan Room  
 Data-Fax

**From:** Nancy Dunham

**Re:** New Liberty Park Middle School: Phase II  
 Architect's Job No. 06-48  
 Addendum No. 1

**Date:** May 18, 2007

**Pages:** 10, including this cover sheet

Please refer to attached Addendum No. 1

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ADDENDUM NO. 1  
NEW LIBERTY PARK MIDDLE SCHOOL - PHASE II  
Architect's Job No. 06-48  
May 18, 2007

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**BIDS DUE:**

Thursday, May 31, 2007, until 2:00 p.m. local time  
Vestavia Hills Board of Education  
1204 Montgomery Highway  
Birmingham, AL 35216

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The Plans and Specifications are here by amended. The following supersedes all contrary and/or conflicting information and is made part of the contract documents.

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**SPECIFICATIONS**

1. **Section 15900 - CONTROLS**

**Replace** the existing Section 15900 with the attached revised Section 15900.



CONTROLS - SECTION 159001.00 GENERAL:1.01 SCOPE:

- A. Include Section 15010 "GENERAL PROVISIONS", with this Section.
- B. Provisions of this Section shall apply to all HVAC work.
- C. All controls shall be Invensys as installed by Hardy Services. Connect to existing Invensys BMCS. All existing equipment in the facility shall be connected to the BMCS. Controls sub Contractor shall obtain existing equipment drawings from Edmonds Engineering, Inc.
- D. Commissioning: Each subcontractor and supplier of equipment shall include in his/her quoted price the cost of furnishing the material requested and the manpower necessary for the operation and maintenance manuals, training, and system verification as specified under Section 15995 - HVAC Commissioning.

2.00 PRODUCTS:2.01 CONTROL SYSTEMS:

- A. Furnish and install complete and ready for operation with control sequences specified below. (The automatic control system shall be by the same manufacturer as the BMCS).
- B. Products of a manufacturer maintaining complete service and parts facilities in Alabama continuously for the last three (3) years: Invensys as installed by Hardy Services.
- C. Control equipment, except for items comprising an integral part of the water or refrigeration piping, shall be installed by trained mechanics employed by the Control Manufacturer.
- D. Include the services of a full time control technician for calibrating and adjusting controls for the first 2 working days after Owner has occupied building.
- E. Before installation, submit for approval five (5) copies of complete power and control wiring and piping diagrams. Hang a photostatic copy of the approved diagram, framed behind glass, in each equipment room. Provide one (1) set of reproducible sepias of "As-Built" control diagrams at completion of project for the Owner's use.
- F. Provide permanent nameplates for control switches and motor starters. Nameplates: engraved laminated plastic with letters legible under normal operating conditions. (White on black).
- G. Permanently identify control devices other than room thermostats, so they may be identified on control diagrams. Provide engraved plastic nameplates for items mounted outside of or on faces of panels. Mark other instruments with indelible ink.

2.02 CONTROL WIRING:

- A. Include control and interlock wiring and power wiring for control panel in this Section. Install in conduit in accordance with provisions of Electrical Work where exposed, concealed in walls or above ceilings other than lay-in type. Provide plenum rated cable above lay-in ceilings (for plenum or non-plenum).
- B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls partitions.
- C. Wire all devices individually to terminal strips in control panels.

- D. Furnish necessary relays and auxiliary contactors and other accessories required. Provide interlock relays per NEC. Coordinate start-stop stations, auxiliary contacts, etc., with supplier of Starters, Variable Frequency Drive (VFD) and Motors Control Centers specified in Electrical Work.

2.03 CONTROL DEVICES:

- A. Room Thermostats: Provide room thermostats with accessible DDC adjustments, override button and communications jack. Thermostats to be provided with local control, limited range of local control or control by BMCS as individually selected through BMCS and BMCS capability to cycle fan with compressors. Thermostat covers: high impact plastic. Mount room thermostats with tops 4 feet above floors.
- B. Remote Bulb Thermostats (DDC) and Temperature Transmitters (DDC): Unless otherwise shown use averaging elements not less than 8 feet long for duct or casing cross sections up to 24 square feet face area and elements not less than 17 feet long for sections over 24 square feet face area.
- C. Thermometers: Pipe line thermometers are specified in another Section. Install digital readout thermometers in ducts where shown on control diagrams, providing averaging bulbs where shown and/or required.
- D. Valves: See Section 15050 "MATERIALS AND METHODS".
- E. Freezestats: Manual reset, pneumatic not permitted. Locate freezestat bulbs between preheat and chilled water coils in units with chilled water coils and downstream from DX coils in units with DX coils.
- F. Flow Switches: Vaporproof enclosures, McDonnell & Miller. Pneumatic not permitted.
- G. Valve and Damper Operators: Of sufficient power to close/open valves and dampers under operating conditions. Electric valve and damper motors shall have oil immersed gear trains and spring return to normal position. Valves and damper operators to have DDC Controls.
- H. Wells: Install pipe line mounted control and indicating devices in stainless steel or brass thermometer wells.
- I. Capillary Supports: Securely support all duct-mounted and casing- mounting thermostat capillaries using factory fabricated copper bulb supports.
- J. Provide stand-offs for control devices mounted on externally insulated ducts and equipment.
- K. Anchor all items mounted on gypsum board (dry-wall) using toggle bolts or moly bolts, not expansion shields.

2.04 CONTROL POWER:

- A. Direct Digital Control (DDC) with DDC power for valves and damper operators. All 120 Volt wiring shall be the responsibility of the Control Sub-Contractor from circuit furnished under Electrical Section.
- B. Power wiring to all automatic dampers shall be included under this section.

2.05 CONTROL PANELS:

- A. Local Control Panels: Construct of galvanized steel with baked enamel finish or aluminum-plywood-aluminum fronts and backs and extruded tops, bottoms, and ends. All panels shall have piano hinges and key locking latches (key panels alike). Permanently label instruments located in panels consistent with labeling on control diagram. Cement photostat of approved diagram inside each panel cover. (Include Local-Remote switching for control point

adjusters on face of each panel).

## 2.06 STAND-ALONE DIGITAL CONTROLLERS (SDC):

### A. SDC Hardware Requirements:

1. Stand-Alone Digital Controllers shall be 16-bit microcomputer based, providing a multi-tasking operating system for control functions simultaneous with all other facility management, operator interface, and system communications functions. SDC's shall include integral devices with full alphanumeric display and a keypad for password controlled access to various levels of operational capability, from simple information access, to full programmability of SDC functions.
2. SDC's shall provide true floating point arithmetic calculations. To accommodate accumulation of large totalized values, the SDC shall support calculation and accumulation of values up to 10 to the thirty-eight power.
3. Application Program Protection:
  - a. All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database, shall be protected from loss due to power failure for a minimum of 10 months. Provide EE Prom nonvolatile memory for these functions.
  - b. Uninterruptible Power Source (U.P.S.): All "SDC" panels shall be protected from power surge and power outage. Provide 5 minute full load runtime, 2 year warranty and \$25,000 lifetime equipment protection. Provide protection for data and telecom lines. U.P.S. shall be equal to APC, "Smart-UPS 700."
4. Multi-tasking: SDC's shall provide the capability to simultaneously perform at least, but not limited to, the following functions.
  - a. Downloading of application program changes to the SDC without affecting the simultaneous operation of existing operating application programming.
  - b. Printing of scheduled or on-demand reports without preempting operator functions.
5. Automatic Temperature Control: The SDC's shall interface to additional panels of equipment as required to provide the performance specified for local Control Panels.
6. Local Control Panel: Each control panel shall be a fully electronic analog control or digital control system, providing all control functions for the equipment specified to be controlled from that panel. Control functions to be performed by control panels are as described in this specification in the sequences of operation, in the point charts, and other relevant sections of these specifications. Every control panel shall be constructed and provided to perform the facilities management requirements of this specifications.
7. Local Control Panel Functions:
  - a. It is the intent of this specification to provide the Owner with the ability to read out temperatures and other values, and to adjust specific items from localized, as well as centralized locations. In order to provide this capability, control panels are specified to be placed in specific locations with readout gauges and adjustments to be mounted directly in the control panel.
  - b. Every control panel shall provide readouts for the temperatures, or other information, specified. Every control panel shall provide adjustments for the setpoints, parameters, and other adjustment functions specified.

**8. Read Out of Items:**

- a. Items specified for read out shall be under continuous display on the face of the panel with either a digital display or analog electronic meter. Read out of sensed variables used in control sequences shall be from the same sensors used for control. As an alternate, provide either a duplicate sensor for the read out, or provide a transducer for each sensed signal which can provide both a read out signal and a signal compatible with the controller.
- b. Each read out items shall be individually named and labeled. Name label shall be directly adjacent to the actual display value of that item. Label shall be a part of the digital display of that value, or a Bakelite label mounted directly above the value display. Display readout requirements are in addition to capabilities provided by plug-in operator devices which are provided as part of digital controller-

9. **Adjustments:** Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all setpoints used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be integral to each control panel. As an alternate provide a "Dumb CRT" and keyboard.

10. **Spare Point Capacity:** Digital controller based control panel bids shall include in every panel, additional capacity for future installation of desired equipment at the Owners discretion. Provide expansion capacity of at least 10% for every panel. Expansion capacity shall include equal quantities of every point type; Analog input, Digital input, Digital output, and Analog output. Systems providing modulating outputs via pulse width modulation techniques, shall provide within each panel all the components required to implement the functions equivalent to an analog output.

**B. Sensing and Control Output Requirements:****1. Sensing:**

- a. All sensing inputs shall be provided via industry standard signals. Temperatures, humidities, differential pressure signals and all other signal inputs shall be one (1) of the following types:

- 0-20 mA
- 4-20 mA
- 0-5 VDC
- 0-12 VDC
- Resistance Signals

- b. All signal inputs shall be compatible with the controllers used, and with the requirement for readout of variables as specified.

**C. Control Outputs:**

1. **On/Off Outputs:** Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting whether the 120 VAC circuit to the contactor is active. All such relays or digital output modules shall provide a pilot light or LED display of this same status.
2. **Modulating Output:**
  - a. Modulating outputs shall be industry standard 0-5 VDC, or 0-12 VDC. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.

- b. All modulating outputs shall provide within the control panel, a metric gauge, or display indication of the commanded position signal to the actuating device. This meter, gauge or display must provide either a 0-100 percent position indication, or read out directly in the engineering units of the signal being used. Drive open/Drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.
3. **Standard Software Function Libraries:** All SDC's shall have a standard feature of their system software, complete libraries of control algorithms for DDC, Energy Management, and Building Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application programming of each individual SDC.
4. **Application Software Documentation:** Control shall provide a blueprint documentation of the software application program for each SDC. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. For systems utilizing program listings. A program listing shall be printed onto the same blueprint shall be stored and maintained in each SDC panel. System acceptance shall not be completed until this documentation is provided and located in each panel.
5. **Energy Management Control:** The SDC's shall individually perform Time of Day Scheduling, Optimum start/stop, Enthalpy optimization, and all control optimization strategies, such as Supply Air Reset and Soft Start Ramp-up, for their connected systems of equipment.

#### 2.07 INTERFACES WITH BUILDING MANAGEMENT CONTROL SYSTEM (BMCS):

- A. Relays actuated by BMCS will be mounted in BMCS Panels located in Fan Rooms, Equipment Rooms, etc.
- B. Wiring from local panels (and Engineer panels) to BMCS panels is included in this Section.
- C. Control point adjusters actuated by BMCS system will be located in BMCS Panels.
- D. Fire Control Panels: Where required will be furnished and installed under Electrical Work. Connections between Fire Control Panel and Fan Starters, damper air solenoids, etc. shall be included under Controls.

#### 2.08 CONTROL SEQUENCES:

- A. **Water Source Heat Pump, Condenser Water Loop System (Towers, Boilers, & Pumps)**
  1. Main Loop Pumps (P-1 & P-2) to start/stop subject to the following:
    - a. BMCS
    - b. Outside air temperature below 35° F (ADJ.)
    - c. WSHP call for cooling or heating or ERU call for cooling.
    - d. VFD to modulate pump motors to maintain differential pressure at two (2) furthest units from pumps. Provide one (1) sensor at two (2) different locations.
  2. Safeties and Miscellaneous Sensors (Same as existing):
    - a. CWR Temperature sensor up stream of all Mech. Rm. Equipment.
    - b. CWS Temperature sensor downstream of all Mech. Rm. Equipment.
    - c. Upon loss of flow across main loop pumps via a differential pressure switch all

WSHP's, boilers, towers, pumps, etc. shall de-energize. BMCS shall continuously call for 1 or the other main loop pump to start until proof of flow is made thru the switch.

- d. Upon sensing a high temp. alarm in the loop water, the following sequence shall occur:
  1. All WSHP's shall de-energize.
  2. All water shall be diverted thru the tower via closing the by-pass and the main loop pump shall energize.
  3. All tower functions shall energize to 100%.
  4. Boiler and boiler circ. Pumps shall be off.
  5. Upon a drop below the high alarm the system shall return to normal.
- e. Upon sensing a low temp. alarm in the loop water the following sequence shall occur:
  1. All WSHP's shall de-energize.
  2. All water shall be diverted thru the tower by-pass and the tower shall de-energize and the main loop pumps shall energize.
  3. Boilers and circ. Pumps shall stage to maintain temperature.
  4. Upon a rise above the low alarm the system shall return to normal.
- f. Upon sensing an outside air temp of 40° F or below the following sequence shall occur:
  1. Main loop pump shall energize.
  2. Minimum water shall flow thru the tower by sequencing by-pass valves.
  3. Boilers and circ. Pumps shall stage to maintain temperature.
  4. Upon a rise above 40° F ambient system to return to normal.

**B. Water Source Heat Pumps:**

1. Start/stop subject to:
  - a. BMCS
  - b. Factory safeties.
  - c. Fire alarm system.
  - d. Proof of flow across main loop pumps (thru BMCS)
  - e. Fan to run continuous or cycle as selected.
2. Upon a call for cooling/heating the unit shall cycle compressors to maintain space temperature.
3. Units scheduled for hot gas reheat: Upon a call for dehumidification via the humidistat the unit shall go into full cooling and the hot gas reheat valve shall modulate to maintain

space temperature. Upon a drop in humidity below set point the unit shall return to normal.

4. Provide night high and low limits t'stat and night high limit humidistat, override button and BMCS limiting.
- C. Energy Recovery Unit, water cooled compressors and Electric Heater: E.R.U. shall start/stop subject to BMCS, 3-hr. mark time switch, fire alarm system, duct smoke detector and factory safeties. The startup procedure shall be as follows:
1. The outdoor air and exhaust air dampers open, the supply fan, exhaust fan and wheel motors shall start.
  2. Normal Operation: The water cooled compressors and electric strip heat shall stage to maintain a discharge air temp of 70°F. (adjustable through BMCS). The electric strip heat is in the reheat position. The compressors and electric strip heat are to be controlled by separate individual discharge air sensors.
  3. The BMCS shall determine the need for dehumidification by sampling OSA/supply air humidity and space humidity. If space humidity is greater than 60% (adjustable through BMCS) or supply air humidity is greater than 70% (adjustable through BMCS) the unit shall go into a dehumidification cycle. The compressors shall stage on 100% and the electric strip heat shall maintain a discharge air temperature of 70°F. (adjustable). Upon the humidity falling back below setpoint the unit shall return to normal operation.
  4. Safety: The outdoor air and exhaust air auto damper end switches stop the supply and exhaust fan when the dampers start to close. A current switch is installed in the supply and exhaust fan starter. The BMCS uses this switch to confirm the fan is in the desired state (i.e., on or off) and generates an alarm if status deviates from BMCS start/stop control.
  5. Unoccupied Dehumidification cycle: If the space humidity is sensed to be higher than 70% (ADJ) during unoccupied hours, the unit shall energize into the unoccupied dehumidification cycle. This dehumidification cycle is the same as indicated above except that the exhaust air and outside air dampers are closed, the by-pass damper is open and the wheel is off. Upon the humidity fall back below setpoint, the unit shall return to normal operation.
  6. Night high limit humidistat.
  7. Units with CO<sup>2</sup> Monitors / Sensors:
    - a. Provide CO<sup>2</sup> monitors with ± 5% accuracy, for ERU-GYMD control. Locate monitors in space being served, beside thermostats. Provide override at BMCS.
    - b. GRU-GYMD:
      1. Upon a fall in CO<sup>2</sup> levels below 1000 PPM the ERU shall de-energize and all auto dampers shall close. The auto outside air damper for WSHP-D111A shall open to set position.
      2. Upon a rise in CO<sup>2</sup> levels above 1000 PPM the ERU shall sequence as listed above. The auto outside air damper for WSHP-D111A shall close.
- D. Unit Heater Controls, Electric, EUH: Unit mounted thermostat to cycle fan and energize electric heat in steps as scheduled to maintain space temperature. No BMCS connection required.
- E. General Interlock Exhaust Fans: Provide "H-O-A" switch for each fan. In "Auto" position

respective fan to be interlocked to operate with scheduled AC Unit subject to fire alarm relay - see Electrical. (Fire control panel to have "H-O-A" switch for each exhaust fan for control by Fire Department where required. "H-O-A" switches to be installed on walls in nearest Mechanical Room.)

- F. Exhaust Fan with Remote T'stat Controls: Provide "H-O-A" switch (in fan starter). In "Hand" position fan to run continuously. In "Off" position fan is off. In "Auto" position fan to be energized by room DDC thermostat subject to fire alarm relay - see Electrical. When fan is energized, automatic exhaust and outside air damper at outside air louver shall open and close when fan is off.
- G. EF-E 127H, E 154H, E 214H and E 237H shall be interlocked with a switch on the respective science room exhaust hood. Upon activation, the respective room exhaust fan (EF-E127, E154, E214 or E237) shall turn off. Respective room exhaust fan shall energize once respective hood fan is turned off (subject to BMCS).
- H. Provide all temperature indication, setpoint adjustments, individual start/stop functions, alarms and DDC control functions on BMCS points list.
- I. Domestic Hot Water System: Circulator pumps to have user definable night shutdown sequence thru BMCS. Operation to be continuous during occupied mode.

3.00 EXECUTION:

3.01 INSTALLATION:

- A. Control diagrams on drawings and/or Control Sequences are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown.