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ADDENDUM NO. 4

The Architect/ Engineer issues this addendum, applicable to the above named project, to all known Contractors before receipt of proposal.

This addendum includes Item Number 4-1 thru 4-11. This addendum item shall be fully incorporated into the Bidding/Contract Documents and have the same force and effect as though originally included.

The Bidder shall acknowledge receipt of this Addendum No. 4 on the Bid Proposal Form in the place provided.

ARCHITECTURAL

Specifications

Item 4-1: Section 087100 – Finish Hardware

Under approved manufacturers, subject to meeting the performance criteria of the specified products, add the following manufacturers:

Precision, Hager	Exit Devices
Best, Hager	Locksets
Stanley, Hager	Closers
Hager	Hinges
Hager	Wall Stops & Holders
Hager	Thresholds
Hager	Weatherstripping

MECHANICAL

Specifications

Item 4-2: Section 230593 - Testing Adjusting and Balancing

Add the attached Specification Section 230593 - Testing Adjusting and Balancing in it's entirety.

Drawings

Item 4-3: Sheet M0.4 Third Floor Mechanical Demolition Plan

Delete the notes regarding removal of the two (2) Data Air HVAC units and associated refrigerant piping on 3rd floor serving the computer room since this equipment will be removed by the owner. Contractor to remove all remaining associated refrigerant piping up in air shaft to condensing units, conduit, wiring, (2) rooftop condensing units and all associated piping supports and infill wall openings.

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Item 4-4: Sheet M1.2 First Floor HVAC Plan

Reference the ECH-1's in the East and West Entrance Vestibules: ECH-1 (qty. = 2) to be a Q'mark Model CDF-548 or equivalent with 6.8 MBH, 2 KW, 283 CFM, 51 deg. F. ATR, capacity, provided with 208 Volt, 1 phase, 60 Hz. electrical characteristics, CDF-RE recessed mounting enclosure, power disconnect, CDFT thermostat, and trim ring for mounting in GWB ceiling.

Item 4-5: Sheet M3.1 – Enlarged Basement Mechanical Room

If Alternate M-2 or M-3 is accepted, provide fan wall capable of being disassembled as necessary to fit through the existing approx. 3' x 7' west man door from corridor into North East MER, or remove door jamb and a portion of wall as necessary to allow equipment to enter into the MER and reinstall door jamb and infill wall opening with similar construction as existing.

Item 4-6: Sheet M6.1 – Mechanical Schedule

- Refer to the Hydronic Specialties Schedule and add the following options to the condensate pump CP-1, Remark #16: Provide with pump suction isolation valves, red-line gauge water level glass, 3" inlet strainer, thermometer, lifting eye bolts, discharge pressure gauges, pump pilot lights, fused control circuit transformer, control circuit disconnect, alarm bell with silencer, high water switch monitored by BMS, and change mechanical alternator to electrical alternator.
- Refer to Fan Schedule: Provide RF-1 (typical 5) with belt drive, in lieu of direct drive. Change fan model number to Greenheck BSQ-300-30 or equivalent with 3 HP motor, 2.85 BHP., 685 fan RPM, and max. radiated sones at 5' = 13.9 at the required maximum 11,000 CFM at 0.5 in. WC. TSP. capacity with same 208 volt, 3 phase, 60 HZ. electrical characteristics. Provide RF-1 with maximum housing width of 46", including 1" housing insulation, and suspend from structure as high as possible as noted maintaining min. 36" east side clearance in front of electrical panels with motor cover above fan. Also change the associated BMS furnished VFD from 2 HP to 3 HP. The RF-1 gravity BDD to be installed in the 28/48 RA or equivalent downstream of air flow station and transition from fan outlet as shown. Coordinate duct size with contractor. Air flow station provided by BMS to be a Thermal Dispersion type, Ebtron Gold or equivalent, not the pitot tube type. Coordinate associated electrical requirements with BMS contractor, electrical contractor and electrical engineer.
- Refer to Fire and Smoke Damper Schedule, Remark #6: Change rating of fire damper to 1 ½ hr. rating in accordance with scheduled model number in lieu of 3 hr. to provide 2 hour fire rated chase.

Item 4-7: Sheet M7.4. – Fire Protection Piping Schematic

Refer to Fire Protection Piping Schematic: Delete requirement for sprinkler branch take-offs to the top of the main. Branch take-offs may be from the bottom, side or top as best suited for installation coordinated with all trades and existing conditions.

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ELECTRICAL

Drawings

Item 4-8: Sheet E2.2 – First Floor Power & Auxiliary Systems Plan

In Data 106, the electrical contractor shall provide a combination motor starter/fused disconnect switch for EF-4 (30A, single pole, fused at 15 amps), as noted on the motor control schedule on sheet E3.1. The mechanical contractor is not providing a VFD for this unit.

Item 4-9: Sheet E2.3 – Second Floor Power & Auxiliary Systems Plan

In Data 207, the electrical contractor shall provide a combination motor starter/fused disconnect switch for EF-4 (30A, single pole, fused at 15 amps), as noted on the motor control schedule on sheet E3.1. The mechanical contractor is not providing a VFD for this unit.

Item 4-10: Sheet E2.4 – Third Floor Power & Auxiliary Systems Plan

In Data 307, the electrical contractor shall provide a combination motor starter/fused disconnect switch for EF-4 (30A, single pole, fused at 15 amps), as noted on the motor control schedule on sheet E3.1. The mechanical contractor is not providing a VFD for this unit.

Item 4-11: Sheet E2.5 – Fourth Floor Power & Auxiliary Systems Plan

In Data 407, the electrical contractor shall provide a combination motor starter/fused disconnect switch for EF-4 (30A, single pole, fused at 15 amps), as noted on the motor control schedule on sheet E3.1. The mechanical contractor is not providing a VFD for this unit.

END OF ADDENDUM NO. 4

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

1. GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing (TAB) of air systems.
- B. TAB of hydronic systems.
- C. Measurement of final operating condition of HVAC systems.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.

1.3 REFERENCES

- A. AABC - National Standards for Total System Balance.
- B. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
- C. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- D. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 SUBMITTALS

- A. Submit name of adjusting and balancing agency for approval within 90 days after award of Contract.
- B. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- C. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- D. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- E. Provide reports in letter size, soft cover or 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

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F. Test Reports: Indicate data on of the following forms:

1. AABC National Standards for Total System Balance forms.
2. Forms prepared following ASHRAE 111.
3. NEBB forms.

1.5 PROJECT RECORD DOCUMENTS

- A. Record actual locations of all sensors, flow measuring stations, balancing valves and rough setting.

1.6 QUALITY ASSURANCE

1. Perform total system balance in accordance with one of the following:
2. AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
3. NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.7 QUALIFICATIONS

- A. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.8 ON SITE PRE-BALANCING CONFERENCE

- A. Convene prior to commencing work of this section. At a minimum, the attendees shall include the Architect/Engineer and representatives of the installers of all HVAC systems, including temperature controls. The objective of this meeting is final coordination and verification of system operation and readiness for work of this section.
- B. No balance reports shall be accepted nor final payment made unless such conference occurs and is fully documented as to those attending and subjects covered.

1.9 SEQUENCING

- A. See Section 230500.
- B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.10 SCHEDULING

- A. See Section 230500.

2. PRODUCTS (NOT USED)

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3. EXECUTION

3.1 EXAMINATION

- A. Before commencing work and prior to convening the pre-balancing conference, the TAB agency shall coordinate with the appropriate mechanical contractors that the following conditions have been met:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Hydronic systems are flushed, filled, and vented.
 - 12. Pumps are rotating correctly.
 - 13. Proper strainer baskets are clean and in place.
 - 14. Service and balance valves are open.
- B. Submit field reports at the pre-balancing conference. Report ALL defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within +5 to 10 percent of design for supply systems, return and exhaust systems.
- B. Air Outlets in Negatively Pressurized Spaces: Adjust total to within 0 to -5 percent of design to space.
- C. Air Inlets in Negatively Pressurized Spaces: Adjust total to within 0 to +5 percent of design from space.

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- D. Air Outlets in Positively Pressurized Spaces: Adjust total to within 0 to +5 percent of design to space.
- E. Air Inlets in Positively Pressurized Spaces: Adjust total to within 0 to -5 percent of design from space.
- F. Air Outlets in Non-Pressurized Spaces: Adjust total to within 0 to +10 percent of design to space.
- G. Air Inlets in Non-Pressurized Spaces: Adjust total to within 0 to -10 percent of design from space.
- H. Hydronic Systems: Adjust to within +0 to 10 percent of design.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by dampers.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

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- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- K. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing
 - 1. All air handling units, exhaust fans, VAV boxes, heat exchanger, pumps, diffusers, registers, grilles, unit heaters.
- B. Report Forms
 - 1. Title Page:
 - 1. Name of Testing, Adjusting, and Balancing Agency
 - 2. Address of Testing, Adjusting, and Balancing Agency
 - 3. Telephone number of Testing, Adjusting, and Balancing Agency
 - 4. Project name
 - 5. Project location
 - 6. Project Architect
 - 7. Project Engineer
 - 8. Project Contractor
 - 9. Project altitude

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10. Report date
11. Design versus final performance
12. Notable characteristics of system
13. Description of systems operation sequence
14. Summary of outdoor and exhaust flows.
15. Nomenclature used throughout report
16. Test conditions

2. Instrument List:

1. Instrument
2. Manufacturer
3. Model number
4. Serial number
5. Range
6. Calibration date

3. Electric Motors:

1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

4. V-Belt Drive:

1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

5. Pump Data:

1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure

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9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

6. Chillers:

1. Identification/number
2. Manufacturer
3. Capacity
4. Model number
5. Serial number
6. Evaporator entering water temperature, design and actual
7. Evaporator leaving water temperature, design and actual
8. Evaporator pressure drop, design and actual
9. Evaporator water flow rate, design and actual
10. Condenser entering water temperature, design and actual
11. Condenser pressure drop, design and actual
12. Condenser water flow rate, design and actual

7. Heat Exchanger:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Model number
6. Serial number
7. Primary water entering temperature, design and actual
8. Primary water leaving temperature, design and actual
9. Primary water flow, design and actual
10. Primary water pressure drop, design and actual
11. Secondary water leaving temperature, design and actual
12. Secondary water leaving temperature, design and actual
13. Secondary water flow, design and actual
14. Secondary water pressure drop, design and actual

8. Cooling Coil Data:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual

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10. Water flow, design and actual
11. Water pressure drop, design and actual
12. Entering water temperature, design and actual
13. Leaving water temperature, design and actual
14. Air pressure drop, design and actual

9. Heating Coil Data:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Water flow, design and actual
7. Water pressure drop, design and actual
8. Entering water temperature, design and actual
9. Leaving water temperature, design and actual
10. Entering air temperature, design and actual
11. Leaving air temperature, design and actual
12. Air pressure drop, design and actual

10. Air Moving Equipment

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM
15. Return Air/Outside Air Data:
16. Identification/location
17. Design air flow
18. Actual air flow
19. Design return air flow
20. Actual return air flow
21. Design outside air flow
22. Actual outside air flow
23. Return air temperature
24. Outside air temperature
25. Required mixed air temperature

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26. Actual mixed air temperature
27. Design outside/return air ratio
28. Actual outside/return air ratio

11. Exhaust Fan Data:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

12. Duct Traverse:

1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

13. Terminal Unit Data:

1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

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14. Air Distribution Test Sheet:

1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

END OF SECTION 230593