CITY OF TAMPA

Bob Buckhorn, Mayor **CONTRACT ADMINISTRATION DEPARTMENT**

David L. Vaughn, AIA, Director

ADDENDUM NO. 3

DATE: April 3, 2014

Contract 13-C-00046; David L. Tippin Water Treatment Facility Laboratory Building HVAC Replacement

Bidders on the above referenced project are hereby notified that the following addendum is made to the Contract Documents. BIDS TO BE SUBMITTED SHALL CONFORM TO THIS NOTICE.

Item 1: Plan Sheet M102 Enlarged Plans and Sections: Add Note 7 - Provide 2" duct mounted filter box and 2" filters between outside louvers and outside duct heaters at AH1, AH2 and AH3.

Item 2: Replace specification 15763 with the attached revised 15763.

Item 3: Replace specification 15950 with the attached revised 15950.

Item 4: Add attached specification 15865.

Item 5: Roof Clarification: The existing roof is Garland. A copy of the warranty is attached. Contact for the Garland Warranty is:

Henry Passerini
Territory Manager, West-Central Florida
727-709-4280
HPasserini@aol.com

Item 6: Replace Proposal page P-3R with the attached revised Proposal page P-3RR.

All other provisions of the Contract Documents and Specifications not in conflict with this Addendum shall remain in full force and effect. Questions are to be e-mailed to Contract Administration@tampagov.net.

Jim Greiner

Jim Greiner, P.E., Contract Management Supervisor

SECTION 15763 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. The scope of work for this project consists of installing the air handler, and providing a warranty as indicated herein for the air handler and its installation. Extent of air handling unit work is indicated by drawings and schedules, and by requirements of this section.

B. Types of air handling units required for project include the following:

1. Factory fabricated variable volume air handling unit.

C. Refer to other Division-15 sections for piping; ductwork; and testing, adjusting and balancing of air handling units; not work of this section.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications for air handling units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

1. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
2. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Handle air handling units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged air handling units or components; replace with new.

B. Store air handling units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final location.

1.5 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air handlers, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

C. Air-Conditioning and Refrigeration Institute (ARI):

1. 430-78 Standard for Central Station Air Handling Units. Directory of Certified Applied Air Conditioning Products

D. Air Moving and Conditioning Association (AMCA):

1. 99-83 Standards Handbook
2. 300-67 Test Code for Sound Rating
3. 301-76 Methods for Calculating Fan Sound Ratings from Laboratory Test Data

E. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

1. 68-78 Method of Testing In-Duct Sound Power Measurement Procedure for Fans

F. American Society for Testing and Materials (ASTM):

1. C423-77 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
2. D3359-83 Measuring Adhesion by Tape Test
3. E84-81* Surface Burning Characteristics of Building Materials
4. E90-81* Airborne-Sound Transmission Loss of Building Partitions, Laboratory Measurement
5. E413-73* Sound Transmission Class, Classification for Determination
6. G23-81 Operating Light-Exposure Apparatus

G. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):

1. 9-1978 Load Ratings and Fatigue Life for Ball Bearings

H. National Fire Protection Association (NFPA):

1. 90A-1985 Installation of Air Conditioning and Ventilating Systems

PART 2 - PRODUCTS

2.1 FACTORY FABRICATED AIR HANDLING UNIT

A. Standards and Certification Compliance:

1. Standards: ARI 430.
2. Certification: ARI Directory of Certified Applied Air Conditioning Products.
3. Operating limits: AMCA 99 (Class A, B, C, as defined by Standard 1401-66).
4. Sound power level ratings: AMCA 300 and 301, or ASHRAE 68.

B. Casings: Double wall, 16 gauge 316 stainless steel, or equivalent strength construction, fastened to a steel support frame. Provide reinforced support points for setting or hanging the unit.

1. All steel shall be 316 stainless steel.

2. Coil and fan casings shall have removable panels for servicing or replacement of components. These removable panels are not to be construed as inspection or access panels.
   a. Unit inspection doors shall be a minimum of 6 inches high by 6 inches wide in each end of fan sections and in other locations shown on the drawings. Doors shall be double wall, insulated, hinged and provided with heavy duty latches. Doors shall be designed to open against the unit static pressure unless properly safety latched and gasketed to prevent air leakage.
   b. Unit access doors shall be provided, as shown on drawings. Access doors shall be double wall, insulated, hinged and provided with heavy duty latches. Minimum door width shall be 12 inches. Door height shall be full height as determined by unit casing but not to exceed 6'-0". Doors shall be hinged to open against fan operating pressure unless properly safety latched and gasketed to prevent air leakage.
   c. Airway access sections with hinged and latched access doors shall be provided as shown on drawings. Sections shall be provided with access doors on each side unless otherwise indicated on drawings. Access sections located downstream of the cooling coil shall be insulated as specified for unit casing.

C. Fan: Double width, double inlet airfoil type, factory balanced. The maximum allowable noise generation is indicated on the drawings. The vibration tolerance is specified in Section, NOISE AND VIBRATION CONTROL. Provide self-aligning, pillow block or flanged type, regreaseable, ball type bearings selected for 200,000 hours average life, per AFBMA Standard 9. Extend grease lines for interior fan or motor bearings to the outside of the casing. Internally mounted motors and drives do not require a separate drive guard.

1. Fan motor and drive: Furnish from the factory with the air handling unit.
2. Flexible connection: Provide for units with internally mounted motor and drive.

D. Fan Section Construction: Fan, motor and drive assembly shall be factory mounted on an isolation frame supported on springs with 1-1/2 inches minimum deflection. Provide thrust restraint spring for fans with horizontal discharge. External vibration isolation, and flexible connections to ductwork and in piping to and from coils are required in addition to the internal isolation.

E. Coils:

1. Tubes: Seamless copper tubing - .025” nominal thickness.
2. Fins: 0.0045 inch copper mechanically bonded or soldered or helically wound around tubing.
3. Headers: Copper, welded steel or cast iron.
4. "U" Bends, Where Used: Machine die formed, silver brazed to tube ends.
5. Coil Casing: l6 gage Type 316 syainless steel with tube supports at 48-inch maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.
6. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.
7. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing. Construct of red brass (non-ferrous) material.
8. Condensate Drain Pan: Condensate drain pan shall be constructed of Type 316 stainless steel and shall be sloped at 1/8" per foot to the outlet. Extend under

cooling coil and header. Provide outlet connection. Insulate pan with not less than 1/2-inch thick, rigid, water impervious insulation of sprayed or foamed-in-place type. Insulation adhesive and inner coating shall comply with NFPA 90A flame spread and smoke generation requirements.

9. Filter Box: Provide for type of filters shown.
10. Internal Insulation:
    a. Materials shall meet NFPA 90A flame spread and smoke generation requirements.
    b. Fiberglass: Provide 2 inch thick. 1-1/2 PCF insulation between the outer casing and the inner liner, factory applied with adhesive and mechanical fasteners. Apply sealant to all visible raw edges and butt joints of insulation. Provide full uncompressed insulation 2” thick under condensate drain pan. Provide additional insulation under coil section with additional protective metal liner if required to meet this specification.

F. Manufacturer: Subject to compliance with requirements, provide air handling units of one the following. Air handlers and chillers will be of the same manufacturer::

1. Carrier
2. McQuay
3. Trane
4. York

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify that coils, filters, motors, drives and other components are matched with the proper air handling unit.

B. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas, and paint.

C. Vacuum clean interior of air handling units prior to operation.

D. Repair air leaks from or into casing that can be heard or felt during normal operation.

3.2 WARRANTY

A. Provide a five-year parts and labor warranty for the air handling unit.

END OF SECTION 15763

SECTION 15950 - HVAC CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 GENERAL REQUIREMENTS:

A. Examine other Sections of the Specifications for requirements that affect work of this Division whether or not such work is specifically mentioned in this Division.

B. Coordinate work with that of other trades affecting, or affected by work of this Division. Cooperate with those trades to assure steady progress of work under contract. It is this controls sub-contractor's responsibility to neatly "line item" work and responsibilities in their bid, of other subcontractors described in this section that are required for a complete HVAC controls system.

1.3 DESCRIPTION OF WORK:

A. Provide a new control system in conformance with these specifications and the requirements of the drawings.

B. Controls applicable to this section include, but are not limited to temperature and humidity sensors, automatic water valves with electric actuators, automatic dampers, control relays, flow meters, and related devices. Work of this Contractor includes installation in conduit, wiring, wells, and enclosures necessary to provide a complete and operable system of controls.

C. The programmable controllers shall be programmed by the controls sub-contractor to be compatible with the building automation systems software. Systems shall communicate via IP/IXP protocol.

D. Extent of the direct digital control and energy management systems work required by this section is indicated on drawings and schedules, and by requirements of this section.

E. Control sequences and control point list are specified on the drawings as “Sequence of Operation”.

F. Refer to other Division-15 sections for installation of instrument wells, valves, and dampers in mechanical systems. Coordinate and communicate with the general contractor that this is not work of this section.

G. Refer to Division-16 sections for power supply wiring for power source to power connection on controls and/or unit control panels. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.4 CONTROLS SUB-CONTRACTOR QUALIFICATIONS:

A. Acceptable manufacturers of control equipment are Johnson Control, Honeywell or KMC. The controls sub-contractor is to be in the exclusive business of installing and factory-representing the above manufacturers. The controls sub-contractor shall have a minimum of five (5) years' experience in the programming, installation and service of commercial DDC control systems. Upon request, the controls sub-contractor shall provide the names and qualifications of the following, who assigned to this project.

1. Controls programmer
2. Controls equipment installer
3. Controls system analyst

B. The controls sub-contractor shall retain the services of a Professional Engineer registered in Florida for performing the functions described below as they apply to the temperature control system.

C. Responsibilities regarding field equipment start-up and checkout

1. Provide support to the contractor to insure all control devices are properly interfaced with HVAC equipment.
2. Perform a point-to-point operational check of each analog and digital point with owner representative present.
3. Power up the panels and verify correct power operation.
4. Verify communications line integrity.
5. Write all software programs and database.
6. Install all software and database in the system.
7. Verify operation of all operating software.
8. Calibrate/adjust/setup field devices as necessary in the order to provide a complete and proper operating system.
9. Notify engineer of any problems related to the design within two (2) working days of find.
10. Work with the engineer to validate operation and final completion of the project.
11. Work with the test and balance agency in balancing and adjusting the HVAC system.

D. Acceptance of the installation

1. Once the job is installed and the controls sub-contractor has thoroughly checked it, then it will be necessary to demonstrate to the Engineer that the project specifications have been met. The controls sub-contractor shall prepare technical demonstrations to the Engineer requiring a random test of not less than 50% of the system points. A representative of the owner must be invited to observe and given 48 hours prior notice prior to the demonstration. The demonstration will occur concurrent with the substantial completion inspection for the project.
2. The controls sub-contractor will provide the necessary data at the time of the demonstration, such that the Engineer can certify the project as complete.
3. The owner will accept the project as substantially complete only after the complete control system has been certified, in writing complete by the engineer and the system has been successfully demonstrated in accordance with the above criteria.

E. Record Drawing Responsibilities

1. The responsibility of the controls sub-contractor to see that the owner receives three (3) complete sets of record drawings and controls program. Provide digital copy of record drawings in PDF. Any and all changes in the project design package shall be reflected in the owner's record drawings before sign off and acceptance by the owner. As-built changes made in the field shall also be reflected in the record drawings.

1.5 DESCRIPTION OF RESPONSIBILITIES PROVIDED BY CONTROLS SUB-CONTRACTOR:

A. Provide to the owner a complete CAD generated point-to-point submittal wiring diagrams and sequences of operation based on the owner's standard. The controls sub-contractor shall include the following information:

1. Location on the drawings of critical control devices such as control panels, auxiliary control panels, static pressure sensors, room temperature sensors, water temperature sensors/wells.
2. Location of all 120/1/60 power sources for the control devices.
3. Control valve sizing (valve CV and pressure drops). Valve schedules.
4. Complete bill of material.
5. Room schedule.
6. Homerun connections between panels.
7. Communication trunk line layout.
8. Lightning protection devices (quantity and location).
9. Surge protection devices (quantity and location).
10. Room temperature sensors
11. Duct temperature sensors
12. Insertion temperature sensors
13. Outside air temperature sensor
14. Pressure sensors (air and water)
15. Differential pressure switches (air and water)
16. Control dampers (installed by sheet metal contractor)
17. Control valves (installed by mechanical contractor)
18. Damper actuators
19. Damper linkages
20. Valve actuators
21. Outboard gear panels (auxiliary panels)
22. Name plates (engraved type)
23. Control relays
24. Varistors
25. Flow meters (installed by the mechanical contractor)
26. Terminal strips
27. Control fuse blocks
28. Power supplies
29. Humidity sensors
30. Transducers
31. Pressure switches
32. End switches
33. Submittal literature on all control devices provided
34. 120/24VAC transformers
35. Warranty
36. Installation of DDC controllers
37. Installation of all electric temperature control devices not in-line
38. Power wiring from junction box at each control panel to power supplies
39. Installation of all power supplies
40. Install all system grounding

B. The programmable controllers shall be programmed by controls sub-contractor to be compatible with existing software and point naming conventions.

1.6 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR:

A. Install all in-line control devices (such as valves, dampers, flow meters, water temperature sensors, air flow control devices, wells, flow switches, differential pressure switches across pumps).

B. Provide operation and maintenance manuals of HVAC equipment purchased.

C. Start-up and check-out of all HVAC equipment.

D. Install copper line connections to in-line devices.

1.7 QUALITY ASSURANCE:

A. All control conduit and wiring shall meet the requirements of Division 16 for materials and installation. All electrical system components shall comply with NEMA and UL standards.

B. Electrical Standards: Provide electrical components of systems which comply with NEMA and UL standards.

C. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for control systems.

D. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.8 PRE-INSTALLATION SUBMITTALS:

A. Submit product data in accordance with the requirements of Section 15010 - Basic Mechanical Requirements, and requirements of Division 1.

B. Provide complete control diagrams and sequence of operations.

C. Submit the following product data: manufacturer's detailed information for each piece of equipment used, identifying each item used. Catalog sheets for each item as specified in the control diagrams. Identify specific model and accessories being used in the control diagram, when two or more devices or models are shown.

D. Provide the following information for each item and device: Proper system label, indication of coordination with submitted catalog information, proper settings and adjustments of instruments, physical dimensions of devices and accessories, and the normal condition of device, such as normally open or closed dampers, valves, and relays.

E. Submit automatic control damper information including amount of leakage, airflow characteristics, and construction of all components. Submit a damper and control valve schedule that shall include sizes, locations and pertinent information required for approval and coordination with the mechanical contractor and sheet metal subcontractor.

F. Maintenance Data: Submit maintenance instructions and spare parts lists for each type of control device. Include product data and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.9 NETWORK AND APPLICATION SPECIFIC CONTROL PANEL SPECIFICATIONS:

A. The Control System shall be capable of integrating multiple building functions including equipment supervision and control alarm management energy management and historical data collection and archiving.

B. The facility management system shall consist of the following:

1. Stand-alone DDC panels
2. Stand-alone application specific controllers (ASCs)
3. Integration via Open protocol to 3rd Party equipment to include:
4. Network Handheld Terminals

C. System architectural design shall eliminate dependence upon any signal device for alarm reporting and control execution. Each DDC 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. Stand-alone DDC panels shall be able to access any data from or send control commands and alarm report directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. Stand-alone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

1.10 NETWORKING / COMMUNICATIONS:

A. The control system shall have network operator workstations and Stand-alone 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 autodial telephone line modem connections or via a combination of the two networking schemes. The operator workstations shall be located as shown on the drawings.

1.11 LOCAL AREA NETWORK:

A. Workstation / DDC Panel Support: DDC panels shall directly reside on a local area network such that communications may be executed directly between controllers directly between workstations and between controllers and workstations on a peer-to-peer basis.

B. Dynamic Data Access: All operator devices and network resident panels shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the local area network. Access to data shall be based upon logical identification of building equipment.

C. Access to system data shall not be restricted by the hardware configuration of the facility management system. The hardware configuration of the FMS network shall be totally transparent to the user when accessing data or developing control programs.

D. General Network Design: Network design shall include the following provisions:

E. High speed data transfer rates for alarm reporting quick report generator from multiple controllers and upload/download efficiency between network devices. The minimum baud rate shall be 1 Megabaud.

1. Support of any combination of controllers directly connected to the local area network. A minimum of 50 devices shall be supported on a single local area network.
2. Detection and accommodation of single or multiple failures of either workstations, DDC panels or the network media. The network shall include provisions for automatically reconfiguring itself to allow all operation equipment to perform their designated functions as effectively as possible in the event of single or multiple failures.
    a. Message and alarm buffering to prevent information from being lost.
    b. Error detection, correction, and retransmission to guarantee data integrity.
    c. Default device definition to prevent loss of alarms or data, and ensure alarms are reported as quickly as possible in the event an operator device does not respond.
    d. Commonly available, multiple sourced, networking components and protocols shall be used to allow the BAS to coexist with other networking applications such as office automation. Ethernet is the acceptable technology.
    e. Use of an industry standard IEEE 802.x protocol. Communications must be of a deterministic nature to assure calculable performance under worst-case network loading.
    f. Synchronization of the real-time clocks in all DDC panels shall be provided.

1.13 MASTER DDC CONTROL PANEL:

A. General: Stand-alone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each stand-alone 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 and the point list.

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

1. Control processes
2. Energy Management applications
3. Alarm Management
4. Historical / Trend Data for all points
5. Maintenance Support applications
6. Custom processes
7. Operator I/O
8. Manual Override monitoring
    a. Point Types: Each DDC panel shall support the following types of point inputs and outputs:

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

C. 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.

D. Serial Communication Ports: Stand-alone DDC panels shall provide at least two RS serial data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard printers, laptop workstations, PC workstations, and panel-mounted or portable DDC panel operator's terminals. Stand-alone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

E. 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. These override switches shall be operable whether the panel is powered or not.

F. 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.

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. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

I. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of all stand-alone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data. Battery back-up of the controller configuration shall not be permitted. Regardless of your approval as a manufacturer, in the event that the stand-alone controllers maintain their programs via batteries, this shall not be acceptable. This removes the need for emergency power to the controllers and reduces the battery back-up requirements. Programs shall be maintained in non-volatile EEPROMS.

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

1.14 SYSTEM SOFTWARE FEATURES:

A. General: All necessary software to form a complete operating system as described in this specification shall be provided. The person machine interface software shall operate on a true Windows based operating system. OS/2, UNIX or any other operating systems shall not be acceptable.

B. 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.

1.15 CONTROL SOFTWARE DESCRIPTION:

A. Pre-tested Control Algorithms: The DDC panels shall have the ability to perform the following pre-tested control algorithms:

1. Two position control
2. Proportional control
3. Proportional plus integral control
4. Proportional, integral, plus derivative control
5. Automatic control loop tuning

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

C. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commends to heavy electrical loads.

D. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

E. Energy Management Applications: DDC panels shall have the ability to perform any or all of the following energy management routines:

1. Time of day scheduling
2. Calendar based scheduling
3. Holiday scheduling
4. Temporary schedule overrides
5. Optimal start
6. Optimal stop
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature compensated load rolling
11. Fans speed / cfm control
12. Heating / Cooling interlock
13. Cold deck reset
14. Hot deck reset
15. Hot water reset
16. Chilled water reset
17. Condenser water reset
18. Chiller sequencing
19. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Execution portion of this specification.

F. Custom Process Programming Capability: DDC panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

G. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:

1. Any system-measured point data or status
2. Any calculated data
3. Any results from other processes
4. User-defined constants
5. Arithmetic functions (+,-,*,/,square root, exp, etc.)
6. Boolean logic operators (and, or, exclusive or, etc.)
7. On-delay / Off-day / One-shot timers

H. Process Triggers: Custom processes may be triggered based on any combination of the following:

1. Time interval
2. Time of day
3. Date
4. Other processes
5. Time programming

I. Events (e.g., point alarms)

J. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other DDC panels on the local area network. In addition, a single process shall be able to issue commands to points in any and all other DDC panels on the local are network.

K. Advisory / Message Generator: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device, buffer the information in a follow-up file, or cause the execution of a dial-up connection to a remote device such as a printer or pager.

L. Custom Process Documentation: The custom control programming feature shall be self-documenting. All interrelationships defined by this feature shall be documented via graphical flowcharts and English language descriptors.

M. Alarm Management: 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 form 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.

N. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.

O. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

P. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.

Q. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PC's used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.

R. Alarm Messages: In addition to the point's descriptor 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. These alarm messages shall be utilized to perform the beeper interface alarm messaging.

S. Each stand-alone DDC panel shall be capable of storing a library of at least 250 alarm messages. Each message may be assignable to any number of points in the panel.

T. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote beeper. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

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

V. Continuous Point Histories: Stand-alone DDC panels shall store point history files for all analog and binary inputs and outputs.

W. The point history routine shall continuously and automatically sample the value of all analog inputs at half-hour intervals. Samples for all point 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 and analog output points shall include a continuous record of the last ten status changes or commands for each point. Continuous histories shall be provided on all points.

X. Control Loop Performance Trends: Stand-alone DDC panels shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds in one-second increments for verification of control loop performance.

Y. Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours, in one-minute intervals, shall be provided. Each stand-alone DDC panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 5000 data samples.

Z. Data Storage and Archiving: Trend data shall be stored at the stand-alone DDC panels, and uploaded 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 zip drive form for use in 3rd party personal computer applications.

AA. Runtime Totalization: Stand-alone DDC panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification

1. The Totalization routine shall have a sampling resolution of one minute or less.
2. 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.

BB Analog / Pulse Totalization: Stand-alone 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.

1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. kWh, gallons, KBTU, tons, etc.).
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. Unique, user-specified messages shall be generated when the limit is reached.

CC. Event Totalization: Stand-alone 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.

1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

1.16 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS:

A. Each stand-alone DDC controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a stand-alone 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.

C. Each ASC shall have sufficient memory to support its own operating system and data bases, including:

1. Control Processes
2. Energy Management Applications
3. Operator I/O (Portable Service Terminal)

D. 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. Provide a portable operator terminal connection to the network at every air handling unit mechanical room. This connection shall allow the operator the capability to access the system information as well as the entire facility. Refer to the specifications on the network terminal below. The network terminal shall operate off of the same passwords as on the workstation.

E. Application specific controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include, but not be limited to, the following:

1. Display temperatures
2. Display status
3. Display setpoints
4. Display control parameters
5. Override binary output control
6. Override analog setpoints
7. Modification of gain and offset constants
8. Entire Network Information

F. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be store such that a power failure of any duration does not necessitate reprogramming the controller.

1.17 APPLICATION DESCRIPTIONS:

A. VV Box Unit Controllers: VV box unit controllers shall support, but not be limited to, the control of the following configurations of VV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion:

1. Single Duct Only
2. Supply / Exhaust

B. VV box unit controllers shall support the following types of point inputs and outputs:

1. Proportional Cooling Outputs
2. Box Heating Outputs
3. Fan Control Output (On/Off Logic, or Proportional Series Fan Logic)

C. The modes of operation supported by the VV box unit controllers shall minimally include, but not be limited to, the following:

1. Day/Weekly schedules
2. Comfort/Occupancy mode
3. Economy mode (standby mode, unoccupied, etc.)
4. Temporary Override mode

D. Occupancy-Based Standby/Comfort Mode Control: Each VV box unit controller shall have a provision for occupancy sensing override. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the VV box unit controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

E. Continuous Zone Temperature Histories: Each VV box unit controller 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 VV box unit controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

G. The controller itself shall consist of 3 individual components; the controller, the actuator / velocity pressure transducer, and the temperature sensor.

H. Power Failure: In the event of the loss of normal power, there shall be an orderly shutdown of all stand-alone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data. Battery back-up of the controller configuration shall not be permitted. Regardless of your approval as a manufacturer, in the event that the stand-alone controllers maintain their programs via batteries, this shall not be acceptable. This removes the need for emergency power to the controllers and reduced the battery back-up requirements. Programs shall be maintained in non-volatile EEPROMS only.

I. Unitary Controllers: Unitary controllers shall support, but not be limited to, the following types of systems to address specific applications described in the Execution portion of this specification, and for future expansion:

1. Vents (ASHRAE Cycle I, II, III, or W)
2. Pumps
3. Fan Coils (four-pipe)
4. Variable Air Volume Boxes

J. Unitary controllers shall support the following types of point inputs and outputs:

1. Drybulb
2. Outdoor Air Enthalpy
3. Differential Temperature
4. Binary Input from a separate controller
5. Heating and Cooling Outputs
6. Fan Output, On/Off Logic Control

K. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the Execution portion of this specification, and for future expansion:

1. Daily/Weekly schedules
2. Comfort/Occupancy mode
3. Standby mode available
4. Unoccupied not available
5. Shutdown
6. Lighting Logic Interlock to Economy Mode

L. Occupancy-Based Standby / Comfort Mode Control: Each unitary controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the unitary controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

M. Continuous Zone Temperature Histories: Each unitary controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance of the past 24 hours. A minimum of two samples per hour shall be stored.

N. Alarm Management: Each unitary controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

O. Power Failure: In the event of the loss of normal power, there shall be an orderly shutdown of all stand-alone DDC panels to prevent the loss of database or operating

system software. Non-volatile memory shall be incorporated for all critical controller configuration data. Battery back-up of the controller configuration shall not be permitted. Regardless of your approval as a manufacturer, in the event that the stand-alone controllers maintain their programs via batteries, this shall not be acceptable. This removes the need for emergency power to the controllers and reduces the battery back-up requirements. Programs shall be maintained in non-volatile EEPROMS only.

P. Air Handler Controllers: AH controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in the Execution portion of this specification, and for future expansion:

1. Large air handlers
2. Mixed air-single path
3. Mixed air-dual path
4. Single path
5. Dual path

Q. AH controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally stand-alone fashion.

R. AH controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the Execution portion of this specification.

S. Occupancy-Based Standby / Comfort Mode Control: Each AH controller shall have a provision of occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the AH controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

T. Continuous Zone Temperature Histories: Each AH controller 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 store.

U. Alarm Management: Each AH controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

V. Power Failure: In the event of the loss of normal power there shall be an orderly shutdown of all stand-alone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data. Battery back-up of the controller configuration shall not be permitted. Regardless of your approval as a manufacturer, in the event that the stand-alone controllers maintain their programs via batteries, this shall not be acceptable. This removes the need for emergency power to the controllers and reduces the battery back-up requirements. Programs shall be maintained in non-volatile EEPROMS only.

W. Open Protocol Application Controller: The BAS shall support open-protocol communications with other vendors equipment to minimize redundant automation networks with the facility and eliminate multiple user interfaces. Connectivity to third party controllers shall be through integrator panels that reside on the BAS network and have down-loadable drivers for accommodation of a specific equipment manufacturers protocol. Interfaces shall be required for the items described in the General Products description of this section. Hardwired interfaces or non-factory supported software gateways shall not be acceptable.

1.18 POINTS LIST SUMMARY AND AS SHOWN ON THE DRAWINGS:

A. Chillers:

1. Water setpoint
2. Water control point
3. Entering chilled water
4. Leaving chilled water
5. Entering condenser water
6. Leaving condenser water
7. Evaporator refrigerant temperature
8. Evaporator pressure
9. Condenser refrigerant temperature
10. Condenser pressure
11. Discharge temperature
12. Bearing temperature
13. Motor winding temperature
14. Oil sump temperature
15. Oil pressure transducer
16. Oil differential pressure
17. Base demand limit
18. Active demand limit
19. Line voltage percent
20. Line voltage actual
21. Compressor motor load
22. Compressor motor current
23. Compressor motor amps
24. Target Vane position
25. Actual van position
26. Total compressor starts
27. Starts in 12 hours
28. Compressor ontime
29. Service ontime
30. Compressor motor kW
31. Demand limit 4-20 mA
32. Temperature Reset 4-20 mA
33. Common CHWS sensor
34. Common CHWR sensor
35. Occupied 0-no, 1-yes
36. Alarm state 0-ok, 1-alarm
37. Chiller start/stop 0-stop, 1-start
38. Hot gas bypass relay 0-no, 1-yes
39. Chilled water pump 0-no, 1-yes
40. Chilled water flow 0-no, 1-yes
41. Condenser water pump 0-no, 1-yes
42. Condenser water flow 0-no, 1-yes
43. Compressor start relay 0-no, 1-yes
44. Compressor start contact 0-no, 1-yes
45. Compressor run contact 0-no, 1-yes
46. Starter Fault contract 0-no, 1-yes
47. Pressure trip contact 0-no, 1-yes
48. Single cycle dropout 0-no, 1-yes
49. Oil pump relay 0-no, 1-yes
50. Oil heater relay 0-no, 1-yes
51. Motor cooling relay 0-no, 1-yes
52. Tower fan relay 0-no, 1-yes

53.	Compressor shunt trip relay	0-no, 1-yes
54.	Alarm relay	0-no, 1-yes
55.	Remote contacts input	0-no, 1-yes

1.19 OPERATOR INTERFACE:

A. Basic Interface Description: Command entry/menu selection process; operator workstation interface software shall minimize operator training through the use of English language prompting, English language point identification, and industry standard PC application software.

B. The operator interface shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device, and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

C. Graphical and Text-Based Displays: At the option of the user, operator workstations shall provide consistent graphical or text-base displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all workstations.

D. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.

E. Passwords shall be exactly the same for all operator devices, including portable or panel-mounted network terminals. Any additions or changes made to password definition shall automatically cause passwords at all DDC panels on a network to be updated and downloaded to minimize the task of maintaining system security. Users shall not be required to update passwords for DDC panels individually.

1. A minimum of five levels of access shall be supported.
   a. Level 1 - Data access and display
   b. Level 2 = Level 1 + Operator Overrides
   c. Level 3 = Level 2 + Database Modification
   d. Level 4 = Level 3 + Database Generation
   e. Level 5 = Level 4 + Password Add/Modification

2. A minimum of 20 passwords shall be supported at each DDC panel.

F. Operators will be able to perform only those commands available for their respective passwords. Menu selections display at any operator device, including portable or panel-mounted devices, shall be limited to only those items defined for the access level of the password used to log on.

G. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

H. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:

1. Start-up or shutdown selected equipment
2. Adjust setpoints
3. Add/Modify/Delete time programming
4. Enable/Disable process execution

5. Lock/Unlock alarm reporting for each point
6. Enable/Disable Totalization for each point
7. Enable/Diable Trending for each point
8. Override PID Loop setpoints
9. Enter temporary override schedules
10. Define Holiday schedules
11. Change time/date
12. Enter/Modify analog alarm limits
13. Enter/Modify analog warning limits
14. View limits
15. Enable/Disable Demand Limiting for each meter
16. Enable/Disable Duty Cycle for each load

I. Logs and Summaries: Reports shall be generated automatically or manually, and directed to either LCD displays, printers, or disk files. As a minimum, the system shall allow the user to easily obtain the following types of reports:

1. A general listing of all points in the network
   a. List all points currently in alarm
   b. List of all off-line points
   c. List all points currently in override status
   d. List of all disable points
   e. List all points currently locked out
   f. List of all items defined in a "follow-up" file
   g. List all weekly schedules
   h. List all holiday programming
   i. List of limits and deadbands

2. Operator transaction file to include person and action performed.

J. Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operators need to specify the address of hardware controller to obtain system information.

K. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

L. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

1. Add / Delete / Modify Stand-alone DDC Panels
2. Add / Delete / Modify Operator Workstations
3. Add / Delete / Modify Application Specific Controllers
4. Add / Delete / Modify points of any type, and all associated point parameters, and tuning constants
5. Add / Delete / Modify alarm reporting definition for each point
6. Add / Delete / Modify control loops
7. Add / Delete / Modify energy management applications
8. Add / Delete / Modify time and calendar based programming
9. Add / Delete / Modify Totalization for every point
10. Add / Delete / Modify Historical Data Trending for every point
11. Add / Delete / Modify custom control processes
12. Add / Delete / Modify dial-up telecommunication definition

13. Add / Delete / Modify all operator passwords
14. Add / Delete / Modify alarm messages

M. Programming Description: Definition of operator device characteristics, DDC panels, individual points, applications, and control sequences shall be performed through fill-in-the- blank templates and graphical programming approach.

N. Graphical programming shall allow the user to define the software configuration of DDC control logic for HVAC system control sequences, fan interlocks, pump interlocks, PID control loops, and other control relationships through the creation of graphical logic flow diagrams.

O. Graphical Programming: Control sequences are created by using a mouse input device to draw interconnecting lines between symbols depicting inputs, operators, (comparisons and mathematical calculations), and outputs of a control sequence. As a minimum, graphic symbols shall be used represent:

1. Process inputs, such as temperature, humidity, or pressure values, status, time, date, or any other measured or calculated system data.
2. Mathematical process operators, such as addition, subtraction, multiplication, or greater than, equal to, less than, etc.
3. Logical process operators such as and, or, exclusive or, not, etc. time delays.
4. Process control outputs such as start/stop control point, analog adjust points, etc.
5. Process calculation outputs
6. Text file outputs and advisories

P. Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single DDC panel, but shall be able to include data from any and all other DDC panels to allow the development of network-wide control strategies. Processes shall also allow the operator to use the results of one process as the input to any number of other processes (cascading).

Q. Sequence Testing and Simulation: A software tools shall be provided, which allows a user to simulate control sequence execution to test strategies before they are actually applied to mechanical systems. Users shall be able to enter hypothetical input data, and verify desire control response and calculation results via graphical displays and hard copy printouts.

R. System Definition / Control Sequence Documentation: All portions of system definition shall be self-documenting to proved hard copy printouts of all configuration and application data. Control process and DDC control loop documentation shall be provided in logical, graphical flow diagram format to allow control sequences to be easily interpreted and modified at any time in the future.

S. Database Save / Restore / Back-up: Back-up copies of all stand-alone DDC panel databases shall be stored in at least one personal computer workstation.

T. Continuous supervision of the integrity of all DDC panel data bases shall be provided. In the even that any DDC panel on the network experiences a loss of its data base for any reason, the system shall automatically download a new copy of the respective data base to restore proper operation. Data base back-up / download shall occur over the local are network without operator intervention. User shall also have the ability to manually execute downloads of any or all portions of a DDC panel's data base.

U. The DDC panel operator terminal shall simultaneously display a minimum of 6 points with full English identification to allow an operator to view single screen dynamic displays depicting entire mechanical systems.

V. The operator functions provided by the DDC panel operator terminal shall include, but not be limited to, the following: As the system is distributed, the information shall be available form any single location of the entire network.

1. Start and stop points
2. Modify setpoints
3. Modify PID loop setpoints
4. Override PID control
5. Change time/date
6. Add / Modify Start / Stop weekly scheduling
7. Add / Modify setpoint weekly scheduling
8. Enter temporary override schedules
9. Define holiday schedules
10. View analog limits
11. Enter / Modify analog warning limits
12. Enter / Modify analog alarm limits
13. Enter / Modify analog differentials
14. View point history files

1.20 DELIVERY, STORAGE AND HANDLING:

A. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons while shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

1.21 RECORD DOCUMENTS:

A. Provide operation and maintenance manuals.

B. Furnish and install plastic encased charts and flow diagrams in each equipment room.

C. One copy of the control system record drawings, submitted as part of the project close-out package. Submission shall be in AutoCAD and PDF format on disk and 3 hard copies, to include the following information:

1. Point-to-point wiring diagrams and sequences of operation
2. Location on the drawings of critical control devices such as control panels, auxiliary control panels, static pressure sensors, room temperature sensors, water temperature sensors/wells.
3. Location of all 120/1/60 power sources for the control devices.
4. Control valve sizing (valve CV and pressure drops). Valve schedules.
5. Complete bill of material.
6. Room schedule.
7. Phone line or internet location for remote system access.
8. Homerun connections between panels.
9. Communication trunk line layouts.
10. Lightning protection devices (quantity and location).
11. Surge protection devices (quantity and location).

1.22 WARRANTY:

A. Provide full parts and labor warranty on all control devices, panels, and wiring installed during this project for one (1) year from the date of substantial acceptance of the project.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. Low Temperature Detector: Provide manually reset freezestats on outside air AH's with a minimum of 20 foot vapor tension element. Interlock to AH starter to shut unit off in either hand or auto position. Acceptable manufacturers are Johnson Controls A70 or approved equal.

B. Static Pressure Transmitters: Provide electronic supply duct static pressure transmitter as required. Transmitter shall sense the differential between the supply duct and the space pressure. Sensing point shall be located 2/3 downstream in the longest ductwork run. Output shall be 4-20 mA proportional to pressure increase. Accuracy to be ±2% of full range. Acceptable manufacturers are Johnson Controls DPT-2641-6 or approved equal.

C. Water Flow Measurement: The sensor shall be a 4-20 mA output type, with the repeatability of ±.1% of value. Shall incorporate back-lit display and keypad on the meter. Flowmeter shall utilize Vortex shedding technology with a turndown of 20:1. Temperature limits: -40.0ø to 80.0øC. Material is dependent upon that of the size and type of pipe material. Manufacturer: Johnson, Yokogawa, Yewflow Vortex Flowmeter or approved equal.

D. Control Valves Normally Open Two-Way and Three-Way Control Valves: Provide fully proportioning two-way control valves with equal percentage modulating plugs for normally open applications. Valves shall be sized for 3 to 5 psi pressure flow at maximum flow rate. Valves shall have stainless steel stems and spring-loaded Teflon packing. Leakage shall not exceed 0.05 percent of valve CV. Utilize existing pneumatic valves where possible otherwise. Use electric with manual override capability similar to Johnson Controls actuator type M9100 series.

1. Up to 2 Inch: Valves shall be cast brass, screwed ends, ANSI Class 125.
2. 2½ to 6 Inch: Valves to be cast iron, flanged ends, ANSI Class 125.

Manufacturers: Johnson Controls or approved equal.

E. Butterfly Valves: Provide two-way butterfly valves rated per ANSI 150 with fully tapped and threaded lugs and carbon steel body. Valves shall have field replaceable elastomer resilient seats. Disc shall be fabricated from aluminum or manganese bronze and shaft shall be 416, 316 or 17-4PH stainless steel. Manufacturer: Bray Valves or Keystone.

F. Control Dampers: Provide automatic control dampers. Installation by Division 15 contractor per specification section "Ductwork Specialties". Provide damper for low leakage, parallel blade type. Blades to be a minimum 16 gauge galvanized steel of single unit design or 22 gauge galvanized sheet steel of double unit construction. Damper blades shall be 6 inches wide and a maximum length of 60 inches with square block pins of zinc-plated steel. Frames shall be 13 gauge galvanized sheet metal with non-ferrous sleeve type bearings. Dampers shall have solid stops with edge seals so that the blade edges shall interlock with neoprene seals. Leakage shall not exceed 6.3 cfm per square foot with the damper closed against 4 inches w.g. static pressure.

2.2 CURRENT TRANSFORMERS:

A. Current transformers shall be Independent Transformer model 500 or 600 or approved equal.

2.3 CURRENT TRANSDUCER:

A. Current transducer shall be Kele model 4CTV or approved equal.

2.4 CONTROL CONDUCTORS AND CONDUIT:

A. Provide control conductors that meet the BAS manufacturer's requirements and by control diagrams, not less than number 18 AWG stranded copper for all digital signal / control and not less than 18 AWG stranded and shielded copper conductors between controllers. Provide MTW controls conductors within enclosures and number 12 AWG stranded copper (minimum) THHN or THWN power conductors.

B. In unburied indoor concealed locations, provide EMT conduit with compression type fittings in normally cooled / conditioned spaces. Provide aluminum IMC with cast type aluminum screwed fittings in non-cooled / conditioned spaces, including mechanical rooms. Plenum rated cable may be used in plenums only.

C. In unburied outdoor locations, provide weather-tight galvanized steel IMC with cast type galvanized screwed fittings. Provide liquid-tight flexible metallic conduit (18 inches minimum length, 6 feet maximum) for connections to all vibrating equipment. Provide insulated grounding bushings at conduit connections to all boxes and panels. Seal water-tight all conduit penetrations.

D. Conduit buried outdoors and below slabs shall be PVC, in accordance with Division 16 of the specifications.

E. Provide UL approved components and located for accessibility to NEC requirements. Plenum cable on separate supports mounted on vertical walls of the plenum shall be acceptable, provided it is tagged and bundled. Plenum cables where exposed or in walls shall be in Flex, EMT, or Wiremold per NEC. Plenum cable bundles shall not be supported from ductwork or pipes.

F. All control wiring, whether in conduit or bare, shall be home runs without splices.

G. Conduit Markings: In the mechanical rooms and any other location where the conduit is exposed, mark junction boxes to identify controls conduit.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the engineer.

3.2 INSTALLATION OF CONTROL SYSTEMS:

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. The control equipment and connecting wiring shall be installed in a neat and workmanline manner by trained mechanics on staff and under direct supervision of the controls sub-contractor, conforming to all applicable state and local codes.

C. Provide all communications accessories for an operable energy management/direct digital control system.

D. Provide all components, accessories, installation adjustment and testing necessary for an operational system.

E. Provide temperature and humidity sensors, automatic water valves with actuators, control wiring, panels, and other auxiliaries and appurtenances necessary to obtain satisfactory control of mechanical systems and as specified in the control diagrams. Coordinate with Air Distribution System installer for control air requirements. Provide electronic system components necessary to accomplish the automatic control requirements of the mechanical work.

F. Provide conductors and conduit for control systems. Installation shall meet requirements of Division 16.

G. Coordinate and work with Test and Balance Agency to insure proper system adjustments of all control components and control devices such as dampers, valves, etc. Provide the necessary assistance labor to the Test and Balance agency during start-up and check-out periods.

H. All panels shall be installed in accessible locations, free of obstructions from pipes, conduits, ductwork, etc. Unless otherwise shown on contract documents all panels shall be reached from the floor without the use of ladders. Panels that are found to be in violation of these requirements shall be relocated at no cost to the owner.

3.3 LIGHTNING & ELECTROMAGNETIC SUPPRESSION:

A. All interbuilding (building to building) communications shall be over 62/125 X EE-6 meter wavelength fiber installed by Division 16. Fiber optic tranceivers shall be provided by the Controls Installer. Fiber patch panel at hub locations to be provided by Division 16.

B. For protection of the Hayes 1200 Baud Modem Telephone, incorporate a Surge Protector Model PDS-11-Electronic Specialists, Natick, Massachusetts 01760.

3.4 CONTROL WIRING:

A. Install control wiring, without splices between terminal points, color coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.

B. All wiring and piping shall be run straight, parallel to building lines and structure. All wires shall be bundled and independently supported when not in conduit. Flexible wireways shall be limited to six feet long. Reroute wires as directed by engineer when not in compliance with this paragraph.

C. All control points shall be homeruns with no splices and as shown on the control diagrams.

D. All control point wiring shall land at the controller end on a terminal strip, either a separate strip or the I/O strip.

E. Splices shall not be permitted in wireways or AUX cabinets.

F. Wiring shall conform to the manufacturers recommend installation practices including transient suppression on I/O circuit.

G. Wiring shall be labeled to match the control shop drawings.

H. Electrical contractor will provide a 120 VAC junction box at each DDC panel. Controls sub-contractor shall provide all other necessary power and control wiring to all control devices including valves, dampers, variable air volume terminals, and wiring to damper operators, valves, etc.

I. Provide communications accessories for an operable energy management/direct digital control system.

J. Coordinate input and output requirements between controller and remote devices/sensors.

K. Coordinate and work with the general contractor and Test and Balance Agency to insure proper system adjustments of all control components and control devices, such as dampers, valves, etc.

L. Secure controls conduit to building structure. Do not substitute attachments to work of other trades (such as pipes, ducts, other conduits). Provide accessory steel supports, as required. Refer to Division 16 specifications and details for methods of neat and secure support of cables and conduit.

M. Locate control instruments or accessories on insulated/covered casings/pipes/ducts on the finished surfaces of the covering. Seal penetrations to assure no leaks are present around stems that penetrate into the air or water systems.

N. Provide thermowells for all pipe mounted sensors.

O. Identification: Provide engraved laminated plates and valve disks for identification of each: control valve, controls damper, controls panel, flow sensor, display gauge, and sensor (not internal panel gauges). Label all nonpanel devices (as well as instruments mounted in face of panels) to indicate system function.

P. Provide a room temperature sensor for each occupied space and as indicated on the drawings.

Q. Provide CT's on all chiller power supplies and provide monitoring of current (power) use.

3.5 TESTS:

A. Test piping during and after installation.

END OF SECTION 15950

SECTION 15865 – LABORATORY EXHAUST FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.2 SUMMARY

A. General: Provide fans as specified herein and of size, type, capacity, and electrical characteristics indicated.

1.3 ADDITIONAL REQUIREMENTS

A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

2. 15200, Noise and Vibration Control
3. 15950, HVAC Control Systems
4. 15990, Testing, Balancing, and Commissioning of HVAC Systems

B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

1. Division 16, ELECTRICAL

1.4 SUBMITTAL

A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
   a. Dimensional outline drawing for each of the specified fans including operating weight.
   b. Dimensional drawing of roof curbs.

2. Performance Data:
   a. Fan brake horsepower (bHP) for each fan at scheduled static pressure including drive losses.
   b. Actual motor horsepower, voltage and phase for each fan.
   c. Fan curve for each fan indicating flow, static (or total) pressure developed, efficiency, and fan speed at the design point.
   d. Fan sound power levels for each fan at operating conditions.
   e. Vibration isolators for each fan located inside the building.

3. Installation Instructions:
   a. Manufacturer's printed instructions for the installation of each type of fan including copies shipped with the equipment.

4. Maintenance Instructions:
   a. Manufacturer's printed instructions for the maintenance of each type of fan provided.

1.5 APPLICABLE STANDARDS

A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.

B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.

C. Certification: AMCA certified as to both sound and performance ratings, and in compliance with the requirements of ARI Standard 670-90.

D. NFPA: Standard 90A, "Installation for the Installation of Air Conditioning and Ventilating Systems", 1999 Revision.

E. NFPA: Standard 91, "Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal of Conveying", 1999 Revision.

F. NFPA: Standard 96, "Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment", 1998 Revision.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General:.

1. Strobic Air Corporation as the base bid proposal.
2. Approved equal by engineer as alternate bid item for review by the Architect and Engineer

2.2 MIXED FLOW INDUCTION LABORATORY EXHAUST FAN SYSTEM

A. Laboratory Hood Exhaust Fan:

1. Mixed flow high plume roof mounted exhaust fan designed for induced dilution complete with fan, motor, wind screen, inlet mixing plenum, bypass dampers and operators, isolation dampers and operators, manufacturer’s roof curb.
2. Fan manufacturer shall provide a 7 year warranty from time of purchase to include fan, motor and all drive mechanisms including pillow blocks, sheaves, shafts, couplings and belts.
3. Laboratory hood exhaust fan shall be equipped with twin FRP discharge nozzle with passive third central stack for aspiration effect; unit shall have fiberglass entrainment windband to provide secondary induction and reduce unit center of gravity. Induction shall occur downstream of the fan impeller; overall total mass discharge of 270% of design exhaust rate. Manufacturer to submit discharge volume for all fans at specified primary exhaust flow.
4. Fan shall have mixed flow impeller with combination axial/backward curved blades, welded steel construction, with stationary discharge guide vane section. Fan shall have non-stall and non-overloading characteristics with stable performance throughout its full operating range. Fans with surge zones or surge lines will not be accepted. Unit shall be direct drive with impeller mounted directly to the motor shaft; drive arrangement type 4.
5. Fan dynamic balance not to exceed 0.5 mil, peak-to-peak for nominal 900RPM, 1200RPM, and 1800RPM fans, or 0.055 in/sec -peak for 1800 RPM, 0.035 in/sec

– peak for 1200 RPM, and 0.030 in/sec-peak for 900 RPM fans measured at the blade pass area when operating at fan frequency. Vibration isolation shall be limited to rubber-in-shear pad type isolators. The cost of any field corrections required, due to excessive vibration, shall be borne by the contractor and/or the unit manufacturer. To qualify as successful bidder, the manufacturer must agree, in writing, that he shall accept a back charge for any additional field balancing required due to excessive vibration.

6. Motor shall be isolated from the primary exhaust air stream and shall be accessible from the fan exterior for inspection and service.
7. Inlet mixing plenums shall be provided by the fan manufacturer. Each plenum shall be sized to support the weight and performance requirement of the number of fans listed on the schedule. Multiple fan plenums shall be insulated double wall construction with structural stiffeners. Double wall plenums shall have an overall minimum wall thickness of 1.5”, and the insulation shall have a minimum R-value of 4.34. Outer skin of double wall plenums shall be stainless steel 316; obtain written documentation of color approval from the Architect for exterior coating. Inner skin shall be uncoated 18Ga 316 stainless steel. Multiple fan plenums shall be able to withstand 12 in. w.g. of pressure.
8. Fans shall be spark resistant construction per AMCA “C”. All fasteners shall be 316 stainless steel.
9. All fan interior and exterior metal surfaces shall be coated; obtain written documentation of color approval from the Architect for exterior coating. Provide standard laboratory exhaust applications with epoxy-phenolic coating, minimum 16 mils dry film thickness inside and out, plus an additional 2-3 mils (dry film thickness) of UV resistant polyurethane topcoat on all external metallic surfaces.
10. Bypass dampers shall be provided for mixing outside air with primary exhaust. Dampers shall be stainless steel 316 opposed blade low leakage airfoil units with extended shafts for operator connection. Integral acoustical louvers are to be furnished to provide attenuation of damper break-away values. Dampers and acoustical louvers shall be complete with screened rain hoods. Bypass dampers shall be controlled by an electronic modulating actuator factory furnished, mounted and wired.
11. Provide unit with opposed blade, airfoil isolation dampers under each fan. Isolation damper shall be low leakage type constructed of Stainless Steel 316 airfoil blades. Operators shall be 2 position, spring return 110V electric; operators shall be factory furnished, mounted and wired, via a transformer to the fan disconnect switch, to open when the fan is energized and close via a spring return when de-energized. When the fan ships separate from the plenum, all wiring and conduit shall be factory supplied for easy connection in the field.
12. Fan shall be provided with internal drain system to prevent water from entering the building.
13. Roof curb shall be welded galvanized steel construction, 24” high.
14. Vortex breakers or manually adjustable inlet guide vanes shall be provided on all side inlet and multiple fan plenums; to defend against non-laminar air flow system effect.

PART 3 - EXECUTION

3.1 PLACEMENT AND MOUNTING

A. Installation: Fan location shall be as indicated, however, actual placement shall be verified using field measurements and data relating to the equipment approved for actual installation. Mount fan and backdraft damper in strict accordance with manufacturer's instructions.

B. Roof Mounted: Verify the location of the roof curb with the structural drawings. Coordinate the installation with the requirements of Division 7, THERMAL AND MOISTURE PROTECTION.

3.2 SOUND AND VIBRATION CONTROL

A. Reference: Refer to paragraph entitled "FLEXIBLE DUCT EQUIPMENT CONNECTION in Section 15910, for airside duct connections and to Section 15200, Noise and Vibration Control, for vibration hangers.

1. Curb Mounted Units:
   a. Connect inlet ducts to roof curb inlet flanges using flexible duct connectors. Support ductwork so that the connectors are not in tension and are aligned with ductwork.

3.3 OPERATING CONTROLS

A. Control Interlock: Interlock the exhaust fans with their associated air handling units such that when the air handling unit is de-energized for any reason the exhaust fans are also de-energized; when the air handling unit starts, the associated exhaust fans shall also start.

3.4 TEST AND BALANCE

A. Checkout: Operate all fans, adjust drive speeds to achieve design air flow, and perform other requirements as indicated in Section 15990, Testing, Balancing, and Commissioning of HVAC Systems.

END OF SECTION 15860

The Garland Company, Inc.

Warranty Number _080072 Effective Date 03/25/2008

Partnership Pledge[SM] Thirty (30) Years
High Performance Built-Up Roofing System Warranty

Owner's Name & Address	Contractor's Name & Address
City of Tampa Water Department	Nations Roof
1725 North 30th Street	3311 Bartlett Blvd.
Tampa , FL _33610	Orlando, FL _32811

Building Name	Tampa Water Department	Roofing System	StressPly EUVMineral
Roof Identification	HRWTP - LAB Building # 16	Flashing System	StressPly EUV IV
Completion Date	03/10/2008	Square Footage	3,700

MANUFACTURER RESPONSIBILITIES

The Garland Company, Inc. (hereinafter referred to as "Garland"), a Corporation of the State of Ohio, warrants to the above named owner that, when the above specified roofing system is installed in accordance with current Garland approved specifications, Garland will pay all authorized costs of repairs to the roofing system necessary to stop any leaks which occur during a period of thirty (30) years, from the completion date, subject to the terms of this warranty. Leaks which occur only as a result of any of the following will be repaired:

A. Deterioration of the roofing system or flashing system resulting from ordinary wear and tear by the elements.
B. Workmanship on the part of the approved roofing contractor in the application of the roofing system.
C. Splits or breaks in the roofing system not caused by structural movement or failure or movement of any material underlying the roofing system or base flashing.
D. Blisters, wrinkles, ridges, fishmouths or open laps in the roofing system.
E. Slippage of the roofing system or flashing system.

Garland's obligation for repair, removal or replacement remedies under this warranty shall in no event exceed the cost of the original materials of this project. The original cost does not include the cost of removing any preexisting roofing. The costs of removal or replacement of all roofing system components except the above mentioned roofing system shall be borne by owner.

APPLICABILITY OF WARRANTY

This warranty is valid only when applied by a Garland approved roofing contractor for approved roofing system specifications. All repairs, changes, alterations, modifications and additions to the roofing system must be authorized in advance in writing by Garland. This warranty is not assignable, directly or indirectly as a result of the sale of the premises or otherwise. This warranty shall not be applicable if, in the sole judgment of Garland, any of the following shall occur:

A. The roofing system is damaged by natural disasters including, but not limited to, fire, floods, lightning, hail, earthquakes, wind damage, etc..
B. The roofing system is damaged by structural movement or failure or movement of any material underlying the roofing system or base flashing.
C. The roofing system is damaged by acts of negligence, misuse or accidents including, but not limited to, use of roof for other than waterproofing the building, vandalism, civil disobedience or acts of war.
D. Discoloration, cosmetic deterioration or change in the visual appearance of the roofing system or Garland's top coating.
E. Damage to the roofing system resulting from:
    1. Infiltration or condensation of moisture in, through, or around walls, copings, building structure or underlying or surrounding areas.
    2. Lack of positive drainage.
    3. Movement or deterioration of metal adjacent or built into the roofing system or base flashing.
    4. Chemical contaminate attacks on the roofing system which have not been approved or accepted by Garland.
    5. Building design or construction.
    6. Traffic or storage of materials on roof.
    7. Defects in, failure or improper application of the underlying material used as a base upon which the roof is applied.
    8. Acts of parties other than manufacturer or authorized roofing contractor.
F. Failure of owner to properly notify Garland in writing and receive written approval of:
    1. Changes in the usage of the building.
    2. Modifications or additions to the roofing system.
G. Failure of owner to properly maintain the roof.
H. Failure of owner to comply with each and every term or condition stated herein.

Garland assumes no responsibility for damage that occurs to the structure or interior of the structure, including the contents therein, from any type of leaks or any other consequential damages. Garland's sole responsibility is the costs of repairs of the above mentioned roofing system.

OWNER RESPONSIBILITIES

In the event of a leak, owner will notify Garland immediately in writing after discovery of the leak. Garland will inspect the roofing system. If it is determined that the roof leaks were the direct result of warrantable items as delineated within the terms of this warranty, Garland will perform the repairs required to correct the roof leaks at no cost to owner.

Owner will notify Garland in writing within thirty (30) days of any proposed modification, repair or addition, on or through the roofing system or base flashing for each situation occurring after the completion date of this warranty prior to the commencement of same. Owner will also notify Garland in writing within thirty (30) days of changes in the original usage of the building. Drawings or plans showing the location of the proposed changes in the original usage of the building must be provided and approved by Garland.

ALL IMPLIED WARRANTIES INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED FROM THE SALE OF PRODUCTS COVERED BY THIS WARRANTY.

Garland recommends owner participation in the Garland Roof Maintenance and Inspection Program.

This warranty becomes effective only upon full payment of all bills for supplies and installation of the Garland roofing system.

This warranty shall be construed under and in accordance with the laws of the State of Ohio. This warranty constitutes the sole and only warranty of the parties hereto and supersedes any prior understandings or written or oral warranties between the parties respecting the subject matter within.

In the event that any one or more of the provisions contained in this warranty shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision thereof, and this warranty shall be construed as if the invalid, illegal or unenforceable provision had never been contained therein.

INSPECTION REQUIREMENTS

Owner must request in writing an inspection of the roof at any time between the sixth and tenth months of each fifth-year (5, 10, 15, 20, 25) of this warranty's duration. Upon receipt of such request, Garland will provide an inspection of the roofing system by a Garland representative to determine whether any repairs are required to make the system eligible for the continuation of this warranty, submitting a detailed inspection report to owner outlining the nature and extent of such required repairs such as repairs to physical damage, debris removal, drainage clearance, pitch box, coping metal edge and reglet seals and flashing reflectivity.

After the owner has caused any required repairs to be made (at its sole expense and by a contractor approved by Garland) and notifies Garland in writing of it desire for warranty continuation no later than sixty (60) days prior to the date of the inspection requirement. Garland will then provide a reinspection of the roofing system. When Garland has determined the roofing system's acceptability for a continuation, it will notify owner of whatever standard warranty fee is then in effect. The cost of inspection will be paid by the owner at the rate of $200.00 per day plus travel expenses. Upon payment by owner of the warranty fee, this warranty will be continued until the next inspection requirement.

The Garland Company, Inc.
3800 East 91st Street, Cleveland, Ohio 44105

By G R Olivier
Title Secretary
Date 03/25/2008

Warranty Acceptance:
Owner hereby accepts and agrees to the terms and conditions set forth in this warranty.

Owner City of Tampa
Signed By Robert Klein Contracts/Procurement Supervisor
Date 4-2-2008

Item No.	Description	Unit	Approx. Quantity	Unit Price in Words		Unit Price		Total Computed Price
1	The work includes the furnishing of all labor, equipment, and material for the removal and replacement of associated ductwork, piping, valves, testing and balance of a new HVAC system, a new HVAC control system, electrical work, roof insulation, cabinet replacement, minor plumbing work, interior painting, and all associated work required for a complete project in accordance with the Contract Documents.	1	LS		$		$	
1020	Contingency Allowance	1	LS	One Hundred FiftyThousand Dollars and No Cents	$	150,000.00	$	150000
01230-1	Conduit Support	50	EA		$		$	
01230-2	Cable Support	100	EA		$		$	
01230-3	Junction Box Cover	100	EA		$		$	
01230-4	Fire Wall Penetration Seal	25	EA		$		$	
						TOTAL	$	