



ADVERTISEMENT DATE: **March 24, 2025**

**HAMILTON COUNTY DEPARTMENT OF EDUCATION**  
**3074 Claude Ramsey Parkway**  
**Chattanooga, Tennessee 37421**  
**(423) 498-7030**  
**INVITATION TO BID (ITB)**

**BID 25-27, Control Updates at Bess T. Shephard**

Sealed envelopes containing bids must be sent to the Purchasing Department and addressed to the Hamilton County Department of Education, 3074 Claude Ramsey Parkway, Chattanooga, Tennessee 37421. Proposers must submit and mark an “original” bid, one “copy”, and one “USB Flash Drive” in one (1) sealed envelope. Bid documents may be secured from the Procurement Department at the above address and on our website at [www.hcde.org](http://www.hcde.org) via vendor registry. Bids received shall be opened by the Purchasing Department at the time and place designated in the Solicitation and/or associated addenda. The opening for the ITB shall be open to the public. Bids must be received in the Purchasing Department prior to the designated time for opening. Bids received after the designated time of opening will be considered late and shall be considered Non-Responsive.

<b>SOLICITATION NUMBER &amp; TITLE</b>	BID 25-27, Control Updates at Bess T. Shephard
<b>OPENING/DUE DATE &amp; TIME</b>	April 22, 2025 @ 2:00PM
<b>LOCATION</b>	3074 Claude Ramsey Parkway, Chattanooga, Tennessee 37421
<b>PROCUREMENT CONTACT</b>	Jody Miller
<b>PHONE</b>	423-498-7030
<b>EMAIL</b>	Doe_purchasing@hcde.org
<b>PRE-SOLICITATION MEETING</b>	YES
<b>TYPE</b>	MANDATORY
<b>DATE &amp; TIME</b>	April 8, 2025 @ 11:30AM
<b>LOCATION</b>	Bess T. Shepard Elementary School 7126 Tyner Rd, Chattanooga, TN 37421

**BIDDER NAME** \_\_\_\_\_

HAMILTON COUNTY DEPARTMENT OF EDUCATION  
3074 Claude Ramsey Parkway  
Chattanooga, Tennessee 37421  
(423) 498-7030

INVITATION TO BID (ITB)

**BID 25-27, Control Updates at Bess T. Shephard**

Sealed bids will be received addressed to the **Attention of Purchasing Department, Hamilton County Department of Education**, 3074 Claude Ransey Parkway, Chattanooga, Tennessee 37421, **until 2:00PM, April 22, 2025**. Any bid received after the scheduled closing time for receipt of such bid will be considered late and shall be considered Non-Responsive.

TERMS AND CONDITIONS

These terms and conditions shall be part of the Contract. HCS reserves the right to negotiate other terms and conditions it deems appropriate and necessary under the circumstances to protect the public's trust.

*Note: Throughout this document the terms Proposer, Contractor, Company, Vendor, Firm or Bidder are used interchangeably and refer to any organization submitting a response to any solicitation. Additionally, the words terms, quote, bid, proposal are used interchangeably and refer to the submission in response to any solicitation. Hamilton County Schools, will be referenced as "HCS".*

1. **Quality and Guarantee** - All material on which bids are submitted shall be of the quality and grade specified. Each bid must be accompanied with complete descriptions, catalog cuts, or other illustrations of each item upon which a bid is made. The names of manufacturers and stock numbers shall be clearly indicated. Approximate delivery dates are to be given for each item. Any item bid which does not completely meet stated specifications must be listed as an alternate.
2. **Requirements for Submitting Bids** – Bids made on forms other than the Bid Form will not be considered. No modifications or alterations to the bid documents may be made either by interlineation, supplements or deletions. Documents submitted with modifications of any kind will be ruled non-responsive and the vendor possibly removed or suspended from the bid vendor listing for a period of up to two (2) years. The signature of the person submitting the bid shall be in longhand without erasure.
3. **Bid amendment:** If it becomes evident that an invitation must be amended, a formal written amendment will be issued to all known Bidders. If necessary, a new due date will be established.
4. **Bid delivery:** HCS requires that all bids be submitted and time/date-stamped by the date and before the time specified in the bid documents to be considered, regardless of method of delivery. The time clock in the Procurement Department shall be the official record of the time. HCS is not responsible for any technical difficulties of any vendor in the delivery of its bid. No late bids will be accepted, opened or returned.
5. **Bid forms:** Vendors must complete bid forms contained in the bid package. Failure to fully complete the bid forms may result in rejection of the bid.
  - a. All information shall be entered in ink or typed/computer generated. Mistakes may be crossed out and corrections inserted before submission of your bid. Corrections shall be initialed in ink by the person signing the bid. Corrections and/or modifications received after the closing time specified will not be accepted.

6. **Bid preparation:** Prospective bidders are solely responsible for their own expenses in Bid preparation and subsequent negotiations with HCS, if any.
7. **Bid pricing:** Any bid, and its associated pricing, shall remain valid for at least ninety (90) days after the bid due date, unless otherwise indicated in the bid specifications. Unit price must be shown for all products or services. In case of error in extension, unit price will govern.
8. **Bid submission and transmission:** Bid must be submitted in a sealed envelope with the Bid Number/Name, the closing date and time, as well as your company name provided on the envelope. If your response envelope is enclosed in another envelope/package for delivery, the latter should also be clearly labeled with the same identifying information.
  - a. All bids are to be F.O.B. Hamilton County, TN. All responses to this invitation become the property of HCS. Bids/Bids submitted via e-mail or facsimile machine are unacceptable.
9. **Cooperation with Other Service Providers:** If HCS undertakes or awards other contracts for additional related work, the Service Provider shall fully cooperate with such other Service Providers and HCS employees, and carefully fit its own work to such additional work as may be directed by HCS. The Service Provider shall not commit or permit any act which will interfere with the performance of work by any other Service Provider or County employees.
10. **Withdrawal** - Withdrawal of an inadvertent or erroneous bid or proposal by the vendor (before or after opening) may be permitted, when the Purchasing Department determines it to be appropriate. For an unopened manually submitted bid or proposal in exclusive possession of HCS to be withdrawn, a written request for withdrawal must be submitted to the office of the HCS Purchasing Department by a duly authorized representative of the vendor. To take effect, such requests must be received prior to the time set for the opening. A successfully withdrawn submission may be replaced with another sealed bid / proposal if it is received prior to the time set for the opening. In all cases, determination of bid / proposal receipt will be solely governed by the clock-in time as determined by a clock or timepiece designated by the Purchasing Department. No other clock or timepiece will have any bearing on determining whether or not the bid / proposal has been received prior to the time set for the opening. Electronic bids / proposals are available to be withdrawn by the vendor until the specified opening. An apparent successful bidder alleging a material mistake may be allowed to withdraw their Bid at the option of HCS.
11. **Rights of Owner** - The Hamilton County Board of Education reserves the right to reject any or all bids or any part thereof, to waive technicalities and informalities, and to award a contract to other than the low bidder. The right is reserved to reduce or increase the quantity of any item; and to award contract by item number, or group of items. Price, quality, and suitability will be considered in awarding bids. Samples to be submitted by the bidder upon request.
12. **Negotiation** – Hamilton County Department of Education may select a successful Proposer on the basis of initial offers received without discussions. Therefore, each Bid shall contain the Proposer's best terms from a cost or price, experience and technical and service standpoint. Hamilton County Department of Education reserves the right to enter into negotiations with Proposers. If Hamilton County Department of Education and the selected Proposer cannot negotiate a successful agreement, Hamilton County Department of Education may terminate said negotiations and begin negotiations with the other Proposers. Hamilton County Department of Education retains the right to negotiate with multiple Proposers simultaneously. This process will continue until a Contract has been executed or all Proposers have been rejected. No Proposer shall have any rights against Hamilton County Department of Education arising from such negotiations.
13. **Clarification of Bid Document** - Should a bidder find discrepancies in or omissions from the bid document or should he be in doubt as to its meaning, he shall at once request clarification of the Owner.
14. **Awarding of Contracts** - Award will be made to the most responsive, responsible bidder(s) meeting specifications, who presents the product of service that is in the best interest of HCS. HCS reserves the right: (1) to award bids received on the basis of individual items, or groups of items, or on the entire list

of items; (2) to reject any or all bids, or any part thereof; (3) to waive any informality in the bids; and (4) to accept the bid that is considered lowest and best.

15. **Tax Exemption** - Hamilton County Board of Education is a tax exempt entity/organization and will only pay those taxes for which it is obligated. Hamilton County Board of Education can provide a Government Certificate of Exemption for purchases where the entity's tax exemption may apply. All bidders should include in their bids, all sales and use tax which they are obligated to pay when making purchases for material or sub-contractor services. Sales and Use Tax shall be omitted when requesting pricing related to only equipment, supplies, product or equivalent purchases where the Certificate of Exemption for would exempt Hamilton County Board of Education from paying such taxes.
16. **Meeting Specifications** - By my written signature on this bid, I (we) agree and certify that all items included in the bid meet or exceed any and all specifications covering such items. I (we) further agree, if awarded a contract, to deliver merchandise which meets or exceeds the specifications. Failure to comply with this section will result in removal of your firm from our list of bidders for at least six (6) months. This penalty does not preclude action to enforce specific performance.
17. **Declaration/Statement by Bidder** - The respondent hereby states that he, his company, or any of its employees, agents, officers or proposed sub-contractors have not violated or participated in a violation of, been convicted, or pled "nolo contendere" to any act involving an unlawful restraint of trade such as, but not limited to violations of the Sherman Act (15 U.S.C. § 1-2), the Racketeer Influenced and Corrupt Organizations Act (18 U.S.C. 1961-1968), the Hobbs Act (18 U.S.C. §1961), the mail or wire fraud statutes (18 U.S.C. §1341,1343), the false statements statute (18 U.S.C. §1001), the Tennessee Anti-Trust Act (T.C.A. § 47-25-101) or similar state or federal law. Respondent further states that he, his company or any of its officers, agents, or employees have not been debarred by any governmental agency (Federal, state, or local).
  - a. In submitting this bid, you are certifying that you are aware of the requirements imposed by T.C.A. §49-5-413(d) to conduct criminal background checks through the Tennessee Bureau of Investigation and the Federal Bureau of Investigation on yourself and any of your employees who may come in direct contact with students or who may come on or about school property anytime students are present. You are further certifying that at no time will you ever permit any individual who has committed a sexual offense or who is a registered sex offender to come in direct contact with children or to come on or about school property while students are present.
18. **Drug-Free Workplace Program**- Note: Required for construction services, encouraged for others. Law prohibits state or local governments from contracting for construction services with any private entity having five or more employees who has not furnished a written affidavit by its principal officer at the time of the bid or contract stating that the contractor is in compliance with the provisions of this act. Other organizations are encouraged to ensure that their workplace is Drug-Free
19. **Title VI of the Civil Rights Act of 1964** - No person shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.
20. **Title IX of the Education Amendments of 1972** - Prohibits discrimination based on gender in all programs or activities that receive Federal financial assistance. Title IX also includes same gender harassment as well as student-to-student harassment.
21. **Bid Acceptance**- Bidders shall hold their price and/or discount firm and subject to acceptance by HCS for a period of ninety (90) days from the date of the bid opening, unless otherwise indicated in their bid.
22. **Qualifications of Bidders**- A bidder may be required, before the award, to show to the complete satisfaction of HCS that it has the necessary facilities, ability, insurance, and financial resources to provide the service or goods specified.

23. **Restrictive or Ambiguous Specifications-** It is the responsibility of the prospective bidder to review the entire invitation to bid (ITB) or Invitation to Bid (Bid) packet and to notify the Procurement Department if the specifications are formulated in a manner that would unnecessarily restrict competition. Any such protest or question regarding the specifications of bidding procedures must be received in the Procurement Department *not less than seventy-two hours* prior to the time set for bid opening. These requirements also apply to specifications that are perceived to be ambiguous.
24. **Samples:** Samples of articles, when required, shall be furnished free of cost of any sort to HCS and may be retained for future comparison. Samples which are not destroyed by testing or which are not retained for future comparison will be returned upon request *at bidder expense*.
25. **TN Department Of Revenue Requirements:** Any awarded Vendor must be registered with the Department of Revenue for the collection of Tennessee sales and use tax.
26. **No Contact Policy-** After the date and time established for receipt of bids by the HCS Procurement Department, any contact initiated by any bidder with any HCS representative, other than the Procurement Division representative listed herein, concerning this solicitation is prohibited. Any such unauthorized contact may cause the disqualification of the bidder from this procurement transaction.
27. **Pricing:** Vendors are to quote a firm fixed price or discount for the term of the contract; inclusive of any renewals. Upon notice of request for renewal, or in the event of significant industry wide market changes, the Vendor may request a price increase. Proof of price increase must be supplied to the HCS Procurement Department. HCS reserves the right to accept or reject the requested price increase. If the price increase is rejected, the vendor may:
- Continue with existing prices;
  - Submit a revised request for price increase;
- Or
- not accept the renewal offer.
- a. If a price increase is approved by HCS, the approval notification will be done in writing and the vendor will be notified of the new price schedule. This documentation will become part of the bid file. No approvals will be authorized verbally.
- b. All orders are to be quoted F.O.B. destination.
28. **Quantities-** HCS does not guarantee any quantities of items to be purchased. We will buy these items on an as-needed basis.
29. **TN Cooperative Purchasing:** also known as piggybacking, HCDE reserves the right to extend the terms, conditions and prices of this contract to other institutions (such as State, Local and/or Public Agencies) who express an interest in participating in any contract that results from bids and/or bids. Each of the piggyback institutions will issue their own purchasing documents for purchasing of the goods. Bidder agrees that HCDE shall bear no responsibility or liability for any agreements between Bidder and the other Institution(s) who desire to exercise this option
30. **Acceptance:** all terms and conditions in this contract are deemed to be accepted by the vendor and incorporated in the bid, except the provision(s) which are expressly excluded by the specifications.
31. **Additional Information:** vendors are cautioned that any statement made by any individual or employee of HCS that materially changes any portion of the bid document, either before or after the issuance of the bid documents, shall not be relied upon unless subsequently ratified by a formal written amendment to the bid document.
32. **Alteration or amendments:** no alterations, amendment, changes, modifications or additions to any contract resulting from this bid shall be binding on HCS without the prior written approval of HCS.

33. **Assignment:** contractors shall not assign or sub-contract this agreement, its obligations or rights hereunder to any party, company, partnership, incorporation or person without the prior written consent of HCS.
34. **Brand names:** brand names and numbers, when used, are for reference to indicate the character or quality desired. Equal items will be considered, provided they are clearly identified by manufacturer, part number, diagrams, brochures and other related material, *unless stated otherwise in the bid specifications*. When brand, number, or level of quality is not stated by the bidder, it is understood the offer is exactly as specified.
35. **Code Of Ethics:** all suppliers are expected to adhere to business ethics and professional behaviors as outlined in these documents.
36. **Compliance With All Laws:** companies submitting bids must agree to observe and comply with all federal, state, and local laws, statutes, ordinances, and regulations, including but not limited to title vi of the federal civil rights act of 1964, the equal employment opportunity act and the regulations issued there under by the federal government, the Americans with disabilities act of 1990 and the regulations issued there under by the federal government, in any manner affecting the provision of goods and/or services, and all instructions, prohibitive orders issued, and shall obtain all necessary permits.
37. **Declarative Statement:** any statement or word (e.g., must, shall, will) are declarative statements and the vendor must comply with the conditions. Failure to comply with any such statement may result in their bid being deemed non-responsive and disqualified.
38. **Default:** in case of default by the vendor, HCS may procure the articles or services from other sources and may deduct from any monies due, or that may thereafter become due to the vendor, the difference between the price named in the contract or purchase order and actual cost thereof to HCS. Prices paid by HCS shall be considered the prevailing market price at the time such purchase is made. Periods of performance may be extended if the facts as to the cause of delay justify such extension in the opinion of the procurement director.
39. **Deliveries:** must be accompanied by delivery tickets or packing slips. These shall contain the following information for each item delivered: purchase order number; item number; name of article; quantity; and supplier.
40. **Delivery Of Goods And Services** - it is understood and agreed that this bid shall constitute an offer which, when accepted in writing by Hamilton County Schools, will constitute a valid and binding contract between the undersigned and the Hamilton County Department of Education. Failure to supply needed material and/or services will result in removal of your firm from our list of bidders for at least six (6) months.
41. **Delivery Requirements:** time of delivery shall be stated as the number of calendar days following receipt of the order by the vendor to receipt of the goods or services by HCS. *Note: time of delivery may be a consideration in the award.*
42. **Drug-Free Workplace Program for Construction Services:** law prohibits state or local governments from contracting for construction services with any private entity having five or more employees who has not furnished a written affidavit by its principal officer at the time of the bid or contract stating that the contractor is in compliance with the provisions of this act. Companies, other than construction services, are also encouraged to have and maintain drug-free workplace policies.
43. **Grant Funded Purchases:** for purchases that are grant funded, the grant agreement may contain/require special terms and conditions. If there is a conflict between the terms and conditions of the grant agreement and the general terms and conditions of the bid or bid, the grant agreement terms and conditions shall prevail.
44. **Indemnifications/Hold Harmless:** contractor shall indemnify, defend, save and hold harmless HCDE, the school board, administration, and their agents and employees from any and all suits, claims, actions

or damages of any nature brought because of, arising out of, or related to the contractor's performance under the terms of this contract, including the work of any sub-contractor, and without regard to any allegations of fault.

45. **Insurance Requirements:** The Vendor shall maintain the following minimum insurance requirements throughout the duration of the Agreement. HCS reserves the right to request additional documentation or additional policies be provided at its sole discretion and where deemed in its best interest. HCS in no way represents that the insurance required is sufficient or adequate to protect the Vendor's interest or liabilities.

Vendor shall provide Worker's Compensation Insurance as required by applicable laws of the State of Tennessee and shall provide liability insurances as required. All insurance must be occurrence based. Vendor shall add Hamilton County Department of Education as additional named insured by policy endorsement and provide a certificate of insurance evidencing such coverage and endorsement number (#) for each additional named insured. Complete copies of insurance policies must be provided, if requested. A failure to provide said documentation will be considered a contract breach and grounds for termination of contract or pending award recommendation.

Insurance Required	
Coverage	Amount
Workers Compensation	Statutory Limits of Tennessee
Employers Liability	\$1,000,000 per occurrence
Commercial General Liability	\$1,000,000 each occurrence; \$2,000,000 aggregate
Auto (Truck) Liability	\$1,000,000 each occurrence

46. **Invoices:** will be returned for correction unless they contain the following information: purchase order number; item numbers; description of item; quantity; unit price; extensions; and total.
47. **New equipment:** the vendor shall guarantee that the units submitted for this bid shall be new, and the latest and most improved model of current production, and shall be first quality as to workmanship and materials used in said units. All modifications shall be made at the factory. Demonstrators shall not be acceptable. *Note: when the bid is for services, this item does not apply.*
48. **Non-Collusion:** vendors, by submitting a signed bid, certify that the accompanying bid is not the result of, or affected by, any unlawful act of collusion with any other person or company engaged in the same line of business or commerce, or any other fraudulent act punishable under Tennessee or federal law.
49. **Non-Conflict Statement:** vendors, by submitting a signed bid, agree that it has no public or private interest and shall not acquire directly or indirectly any interest that would conflict in any manner with the provision of its goods or performance of its services. Supplier warrants that no part of the total contract amount provided herein shall be paid directly or indirectly to any officer or employee of HCS as wages, compensation, or gifts in exchange for acting as officer, agent, employee, subcontractor or consultant to the contractor in connections with any goods provided or work contemplated or performed relative to the agreement.
50. **Non-Discrimination Statement:** supplier must agree that no person on the grounds of age, color, disability, gender, genetic information, national origin, political affiliation, race, religion, sexual orientation, or veteran's status shall be excluded from participation in, or be denied benefits of, or be otherwise subjected to discrimination in the performance of this agreement, or in the employment practices of vendor. Supplier shall upon request show proof of such non-discrimination, and shall post in conspicuous places available to all employees and applicants notices of non-discrimination. Suppliers covenants that it complies with the fair wage and hour laws, the national labor relations act, and other federal and state employment laws as applicable. Supplier covenants that it does not engage in any illegal employment practices.

51. **Payment Method**- HCS utilizes two (2) methods of placing orders for products. The first is the use of Purchase Orders. These Purchase Orders will be issued from HCS Procurement Division via the method selected by the vendor during registration. The Purchase Order will detail the quantity, specific items(s) and the contracted price for each item.
- a. The second method is the use of the HCS Credit Card (MASTERCARD). Orders placed with the credit card will list the same information as the Purchase Order. Vendors will be given the card information and approval to process the transactions by the requesting department. Vendors must indicate in their bid response if the vendor will accept the HCS Credit Card (MASTERCARD) as a form of payment. Bidders are prohibited to charge HCS any type of merchant fee from their financial institution to accept this type of payment.
52. **Payment Terms**: HCS payment terms are Net 30 after receipt/inspection of merchandise and receipt of invoice unless otherwise stated in the contract documents.
53. **Public Access to Procurement Information**: Subject to the requirements of the TN Open Records Act, information relating to the award of a particular contract shall be open to the public only after evaluation of that bid or bid has been completed. All public records pertaining to procurement shall be open for inspection during normal business hours as scheduled in advance with the Procurement Department.
54. **Protest of Award**: Any vendor who has submitted a timely bid or bid in response to a solicitation may protest the recommendation of award for a contract by submitting such protest to HCS's Director of Procurement. Any protest must be submitted in writing and be in the possession of the Procurement Department before noon (ET) of the 2nd working day following the public recommendation of contract award.

**FAILURE OF A VENDOR TO FOLLOW THE PROTEST REQUIREMENTS WITHIN THE TIME FRAMES PRESCRIBED IN THIS SECTION CONSTITUTES A WAIVER OF THE PROTEST AND ANY RESULTING CLAIMS.**

55. **Right to Audit**: During all phases of the work and services to be provided hereunder the Provider agrees to permit duly authorized agents and employees of HCS to enter the Provider's offices for the purpose of inspections, reviews and audits during normal working hours. Reviews may also be accomplished at meetings that are arranged at mutually agreeable times and places. The Provider will maintain all books, documents, papers, accounting records, and other evidence pertaining to the fee paid/charged under this Contract and make such materials available at their offices at all reasonable times during the period of this Contract and for seven (7) years from the date of payment under this Contract for inspection by HCS or by any other governmental entity or agency participating in the funding of this Contract, or any authorized agents thereof; copies of said records to be furnished if requested.
56. **Safety Data Sheets**: After award, the successful bidder(s) will be required to provide HCS with a master set of Safety Data Sheets for any applicable products.
57. **Severability**: If any provisions of these Rules or any application thereof to any person or under any circumstance is held to be invalid, such invalidity shall not affect the provisions or applications of these rules which can be given effect without the invalid provision or application, and to this end the provisions of these Rules are declared to be severable.
58. **Termination for Cause**: In the event of any breach of contract by the successful service provider(s), HCS may serve written notice to the service provider of its default, setting forth with specificity the nature of the default. If the defaulting party fails to cure its default within thirty (30) days after receipt of the notice of default, then HCS shall have the right to terminate the contract upon thirty (30) days written notice and pursue all other remedies available to HCS, either at law or in equity.
59. **Termination for Convenience**: Contract may be terminated for convenience by either party by giving written notice to the other, at least sixty (60) days before the effective date of termination unless otherwise

specified in the solicitation and/or contract documents. Said termination shall not be deemed a Breach of Contract.

60. **Termination Due To Non-Appropriation:** HCS shall not be obligated for the Contractor's performance hereunder or by any provision of this Contract during any of HCS's future fiscal years unless and until HCS appropriates funds for this Contract in HCS's Budget for each such future fiscal year.
61. **Terms and Conditions:** In the event of a conflict between the specifications and these terms and conditions, the specifications will govern.
62. **Warranties:** Vendor warrants to HCS that all items delivered and all services rendered shall conform to the specifications, drawings, bid and/or other descriptions furnished and/or incorporated by reference, and will be fit for the particular purpose purchased, of merchantable quality, good workmanship, and free from defects. Vendor extends to HCS all warranties allowed under the U.C.C. Vendor shall provide copies of warranties to the HCS. Return of merchandise not meeting warranties shall be at Vendors expense.
63. **Waiving of Informalities:** HCS reserves the right to waive minor informalities or technicalities when it is in the best interest of HCS.
64. **Governing Law/Jurisdiction:** **The Agreement shall be governed by the laws of the State of Tennessee. Any action brought in law or in equity to enforce any provision of the entire Agreement shall be filed in the appropriate state court in Hamilton County, Tennessee. In any action to enforce this Agreement, the prevailing party shall be entitled to recover its costs and expenses, including reasonable attorney's fees. By submission of a proposal and acceptance of a Purchase Order or Contract, Vendor hereby agrees to adhere to Governing Law/Jurisdiction requirements as described herein.**

**HCS DOES NOT DISCRIMINATE ON THE BASIS OF AGE, COLOR, DISABILITY, GENDER, GENETIC INFORMATION, NATIONAL ORIGIN, POLITICAL AFFILIATION, RACE, RELIGION, SEXUAL ORIENTATION, OR VETERAN'S STATUS IN THE EVALUATION AND AWARD OF BIDS.**

**SPECIAL CONDITIONS****1.0 CONTRACT PERIOD**

1.1 CONSTRUCTION TERM: From the Notice to Proceed or the Purchase Order date, whichever applies: 335 calendar days to substantial completion, 30 calendar days from substantial completion to final completion (total contract days 365).

1.2 The Contract Period is expected to begin May 8, 2025 or soon thereafter.

**2.0 BOND**

2.1 Each bid must be accompanied by a Bid Bond in the amount of 5% of the proposed dollar amount (including applicable Alternates) must be submitted with the bid. Failure to provide a valid Bid Bond at the time of bid submission shall deem Contractor Non-Responsive and therefore ineligible for evaluation and award.

2.2 For any construction Project Total that is equal to or exceeds \$100,000.00, Vendor shall provide a Performance & Payment Bond meeting the HCS requirements for 100% of the Project Total from a surety company authorized to do business in the state of Tennessee or other form satisfactory to HCS. Fees/costs associated with procuring any bonding shall be at the sole expense of the Vendor and such shall be covered by the Project Total provided by Vendor for the associated Project.

**SCOPE OF SERVICES**

**BID 25-27, Control Updates at Bess T. Shephard**

**1.0 SUMMARY OF SCOPE**

1.1 Hamilton County Schools (HCS) seeks to contract with a qualified, experienced, and professional Vendor to changeout the building automation and control system.

**2.0 DETAILED SCOPE OF SERVICES**

2.1 The services and products provided by the Vendor shall include, but not be limited to the following provisions:

2.1.1 Contractor's Responsibilities:

2.1.2 Controls Contractor shall furnish and install all necessary hardware, wiring, computing equipment and software as defined in this specification. Conduit stub outs within walls shall be furnished and installed under Division 26. In areas with cable tray, the Electrical Contractor shall in each classroom & lab provide a box with conduit stubbed out above ceiling & bushed. HVAC control cables will run in cable tray to EMS panels. In areas without cable tray, the Controls Contractor shall provide & install conduit from the sensor or control point location to the nearest EMS panel. Where an EMS panel is added beyond what is shown on the electrical drawings, the Controls Contractor shall provide & install a 1-1/4" conduit path to the nearest EMS panel.

2.1.3 Controls Contractor shall provide one copy of their most recently updated controls software to be installed on the HCDE central site computer.

2.1.4 Provide any upgrades as they become available during the course of the project to system software and install them to the Central system.

2.1.5 All electrical wiring for this system shall be furnished and installed by this contractor and shall be of a uniform color throughout the installation.

2.1.6 5. Contractor shall turn over to HCDE all existing control modules removed.

2.2 System Requirements:

2.2.1 All material and equipment used shall be standard components, regularly manufactured and available and not custom designed especially for this project. All systems and

2.2.2 Components, except site-specific software, shall have previously been thoroughly tested and proven in actual use prior to installation on this project. 2. The system architecture shall be fully modular permitting expansion of application software, system peripherals and field hardware.

2.2.3 The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

2.3 Products Furnished But Not Installed Under This Section:

2.3.1 Sensors and Transmitters:

2.3.1.1 Flow meters

2.3.1.2 Press and temp sensor wells & sockets

2.3.1.3 Temp sensor wells and sockets

2.3.2 Control Valves:

2.3.2.1 Control valves

2.3.3 Control Dampers:

2.3.3.1 Automated Dampers

2.4 Air Terminal Units:

- 2.4.1 1. VAV boxes: VAV Terminal Units shall be furnished configured to accept control inputs from an external building automation system controller as specified.

2.5 Central HVAC Equipment:

- 2.5.1 Packaged AHU or evaporative cooler controls: Unit shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.

2.6 Decentralized HVAC Equipment:

- 2.6.1 Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.

2.7 Low-Voltage Controllers:

- 2.7.1 Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points specified. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by Modbus or BACnet. Start/stop and speed control to be hard wired.

2.8 Communications with Third Party Equipment:

- 2.8.1 1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet or Modbus interface for integration into the Direct Digital Control System described in this section.

2.9 Modbus System Intergration:

- 2.9.1 The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

- 2.9.2 Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:

2.9.2.1 Read/Write Modbus AI Registers

2.9.2.2 Read/Write Modbus AO Registers

2.9.2.3 Read/Write Modbus BI Registers

2.9.2.4 Read/Write Modbus BO Registers

- 2.9.3 All scheduling, alarming, logging, and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.

- 2.9.4 The BAS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

- 2.10 The detailed scope of work and Contractor responsibilities are further defined within the Project Manual, Specifications and/or project plans provided as part of the solicitation. It is the responsibility of the Vendor to review and fully understand all associated project documents.

HAMILTON COUNTY DEPARTMENT OF EDUCATION  
Chattanooga, Tennessee 37421  
SOLICITATION RESPONSE & BID/PROPOSAL FORM

**BID 25-27, Control Updates at Bess T. Shephard**

- 1. Vendor Name \_\_\_\_\_
- 2. Vendor Address \_\_\_\_\_
- 3. City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
- 4. Telephone Number \_\_\_\_\_ Fax Number \_\_\_\_\_
- 5. Contact Person \_\_\_\_\_
- 6. Contact Person's email address \_\_\_\_\_
- 7. By submission of this bid/proposal, each Vendor and each person signing on behalf of any Vendor certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each Vendor is not on the list created pursuant to Tennessee Code Annotated § 12-12-106.
- 8. Authorizing Signature \_\_\_\_\_  
(Sign)
- 9. Authorizing Print Name & Title: \_\_\_\_\_
- 10. Vendor's Hamilton County Business License Number \_\_\_\_\_  
*(If Applicable) Attach A Copy Of The License.*
- 11. I Acknowledge the Receipt Of: (Please Write "Yes" If You Received One)  
Addendum 1 \_\_\_\_\_ Addendum 2 \_\_\_\_\_ Addendum 3 \_\_\_\_\_ Addendum 4 \_\_\_\_\_
- 12. Do you accept the Terms and Conditions of the solicitation/contract? Yes \_\_\_\_\_ No \_\_\_\_\_
- 13. May other Government Agencies in Tennessee purchase these products/services at the same prices as this bid/proposal? Yes \_\_\_\_\_ No \_\_\_\_\_
- 14. Will you accept E-commerce payments? Yes \_\_\_\_\_ No \_\_\_\_\_
- 15. Pricing: Complete following page Bid/Proposal Form

**REMINDER:**

All questions pertaining to this solicitation must be submitted electronically to [doe\\_purchasing@hcde.org](mailto:doe_purchasing@hcde.org) no later than **8 calendar days** prior to the Opening/Due date designated herein. Failure to submit a question in the timeframe indicated above may result in the question going unanswered at the discretion of HCS.

An extension to the opening date does not guarantee an extension to the question deadline period. Such will be communicated in associated addendum posting.

It is the sole responsibility of the Vendor to ensure they receive/obtain all solicitation related documentation.



## BID/PROPOSAL FORM

**COMPANY NAME:** \_\_\_\_\_

**SOLICITATION:** BID 25-27, Control Updates at Bess T. Shephard

**Having carefully examined the Solicitation/Contract Documents, Contractor/Vendor proposes to furnish the Scope of Services as described herein and within all applicable proposal submission documents for the fee(s) as presented below.**

Pricing shall be inclusive of all labor, equipment, supplies, overhead, profit, material, and any other incidental costs required to perform and complete all work as specified in the Solicitation/Contract Documents. All Unit Prices shall be bid at the nearest whole penny.

In the event there is a discrepancy between a subtotal or total amount and the unit prices and extended amounts, the unit prices shall prevail and the corrected extension(s) and total(s) will be considered the price.

HCS requests bids/proposals be submitted on bid/proposal forms provided by the HCS for this solicitation. Fee(s) submitted on other forms, other than those provided by the HCS, may be deemed Non-Responsive upon review by and at the sole discretion of the HCS Purchasing Office.

### Control Updates at Bess T. Shephard

Item	Description	Amount
1	Base Bid	\$
2	General Purpose Allowance	\$10,000
3	Owners Contingency	\$10,000

### ***BID SUMMARY***

<b>PROJECT TOTAL</b>	<b>\$</b>
----------------------	-----------

**PROJECT TOTAL:**

(Use Words to Write Total)

**CERTIFICATE OF COMPLIANCE**

By indication of the authorized signature below, the Proposer/Bidder does hereby make certification and assurance, under penalty of perjury, of the Proposer's/Bidder's compliance with all provisions of this bid/bid and the following items:

1. the laws of the State of Tennessee and Hamilton County;
2. Title VI of the Civil Rights Act of 1964;
3. Title IX of the Education Amendments of 1972
4. the condition that no amount shall be paid directly or indirectly to an employee or official of Hamilton County Department of Education as wages, compensation, or gifts in exchange for acting as an officer, agent, employee, subcontractor, or consultant to the Proposer/Bidder in connection with the procurement under this Bid/RFP.

Signed \_\_\_\_\_ Dated \_\_\_\_\_

Print Name \_\_\_\_\_ Email \_\_\_\_\_

Company \_\_\_\_\_ Telephone No. \_\_\_\_\_

Address \_\_\_\_\_ Fax No. \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**AUTHORIZATION TO BIND**

By signing this proposal, I certify and acknowledge that the information contained in this document is true and correct, containing **NO** misrepresentations. The information is **NOT** tainted by any collusion. I certify and acknowledge that I have reviewed and approved the release of this proposal/bid for HCS's consideration. Further, I am authorized to bind my company to the responses and pricing in these proposal/bid documents, and any subsequent negotiations, as well as execute the actual Contract documents, if selected.

---

Authorized Signature (Officer of the Company)

---

Name of Authorized Signer (Printed or Typed)

---

Title of Authorized Signer

---

Firm Name

---

Taxpayer Identification Number

---

Firm Address, City and Zip Code

---

Telephone Number

---

Fax Number

---

Email Address

---

Date

**Drug-Free Workplace Requirements & Affidavit  
TENNESSEE CODE ANNOTATED, § 50-9-113**

- (1) Each Contractor or Subcontractor with no less than five (5) employees receiving pay shall submit an affidavit stating that such employer has a drug-free workplace program in effect at the time of submission of bids. Said program shall comply with Title 50, Chapter 9, TCA.
- (2) If it is determined that an employer subject to the provisions of this section has entered into a contract for this Project and does not have a drug-free workplace pursuant to the referenced requirements, such employer shall be prohibited from entering into another contract with any local government or state agency until such employer can prove compliance.
- (3) The written affidavit shall be submitted with the Construction Contractor's Bid Form, and the Bid shall not be considered complete if said affidavit is not included, and the Bid shall be rejected as Non-Responsive. For all other product or service contracts submission of the affidavit is encouraged only.
- (4) For purposes of compliance with this section, any private employer shall obtain a certificate of compliance with the applicable portions of the Drug-Free Workplace Act from the Department of Labor and Workforce Development.

(To be submitted with bid by construction contractor with 5 or more employees and encouraged for all others)

**AFFIDAVIT**

I \_\_\_\_\_, president or other principal

Officer of \_\_\_\_\_, swear or affirm that the  
(Name of Company)

Company has a drug-free workplace program that complies with Title 50, Chapter 9, Tennessee Code Annotated, in effect at the time of this bid submission at least to the extent required of governmental entities. I further swear or affirm that the company is in compliance with the Tennessee Code Annotated, § 50-9-113.

\_\_\_\_\_  
President of Principal Officer

For: \_\_\_\_\_

STATE OF TENNESSEE}  
COUNTY OF \_\_\_\_\_}

Subscribed and sworn before me by \_\_\_\_\_, President

or principal officer of \_\_\_\_\_,

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC

My Commission Expires: \_\_\_\_\_

### Instructions for Non-Collusion Affidavit

- (1) This non-collusion affidavit is material to any contract awarded pursuant to this bid.
- (2) This non-collusion affidavit must be executed by the member, officer, or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.
- (3) Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that such statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the bidder with responsibilities for the preparation, approval or submission of the bid.
- (4) In the case of a bid submitted by a joint venture, each party to the venture must be identified in the bid documents, and an affidavit must be submitted separately on behalf of each party.
- (5) The term "complementary bid" as used in the Affidavit has the meaning commonly associated with that term in the bidding process, and includes the knowing submission of bids higher than the bid of another firm, and intentionally high or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.

**Non-Collusion Affidavit  
(Attachment A)**

State of \_\_\_\_\_

County of \_\_\_\_\_

I state that I am \_\_\_\_\_ of \_\_\_\_\_  
(Title) (Name of Firm)

and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this bid.

I state that:

- (1) The price(s) and amount of this bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder, or potential bidder.
- (2) Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.
- (3) No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.
- (4) The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.
- (5) \_\_\_\_\_, its affiliates, subsidiaries, officers, directors and  
(Name of my Firm)  
employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by State or Federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

I state that \_\_\_\_\_ understands and acknowledges that the  
(Name of my Firm)

above representation are material and important and will be relied on by Hamilton County Department of Education in awarding the contract(s) for which this bid is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from Hamilton County Department of Education of the true facts relating to submission of bids for this contract.

\_\_\_\_\_  
(Signature and Company Position)

SWORN TO AND SUBSCRIBED  
BEFORE ME THIS \_\_\_\_\_ DAY OF  
\_\_\_\_\_, 20 \_\_\_\_\_

NOTARY PUBLIC:

My Commission Expires: \_\_\_\_\_

**CERTIFICATION OF COMPLIANCE WITH  
THE IRAN DIVESTMENT ACT**

Effective July 1, 2016, this form must be submitted for any contract that is subject to the Iran Divestment Act, Tenn. Code Ann. § 12-12-101, et seq., ("Act"). This form must be submitted with any bid or bid regardless of where the principal place of business is located.

Pursuant to the Act, this certification must be completed by any corporation, general partnership, limited partnership, limited liability partnership, joint venture, nonprofit organization, or other business organization that is contracting with a political subdivision of the State of Tennessee.

**Certification Requirements.**

No state agency or local government shall enter into any contract subject to the Act, or amend or renew any such contract with any bidder/contractor who is found ineligible under the Act.

Complete all sections of this certification and sign and date it, under oath, in the presence of a Notary Public or a person authorized to take an oath in another state.

**CERTIFICATION:**

I, the undersigned, certify that by submission of this bid, each bidder and each person signing on behalf of any Respondent certifies, and in the case of a joint bid or contract each party thereto certifies, as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to Tenn. Code Ann. § 12-12-106.

Respondent represents it has the full power, knowledge, and authority to make this Certification and that the signatory signing this Certification on behalf of bidder/contractor has been duly authorized to do so on behalf of the bidder/contractor.

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Signature of Authorized Official

State of \_\_\_\_\_

County of \_\_\_\_\_

The foregoing instrument was signed and acknowledged before me, by means of  physical presence or  personally known, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by

\_\_\_\_\_ who has produced \_\_\_\_\_ as identification.  
(Print or Type Name) (Type of Identification and Number)

\_\_\_\_\_  
Notary Public Signature

\_\_\_\_\_  
Printed Name of Notary Public

\_\_\_\_\_  
Notary Commission Number/Expiration

The signee of these Affidavit guarantees, as evidenced by the sworn affidavit required herein, the truth and accuracy of this affidavit to interrogatories hereinafter made.

**Hamilton County Board of Education  
Certification Regarding Debarment, Suspension,  
Ineligibility and Voluntary Exclusion**

The prospective participant / vendor certifies, by submission of this bid, that neither it nor its Principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal Department or agency.

Where the prospective participant / vendor is unable to certify to any of the statements in this Certification, such prospective participant / vendor shall attach an explanation to this bid.

Organization Name \_\_\_\_\_

Name(s) and Title(s) of Authorized Representative(s) \_\_\_\_\_

Signature \_\_\_\_\_

## Certification of Compliance with Tennessee Public Chapter # 587

The General Assembly of the State of Tennessee requires any person, corporation or other entity who enters into or renews a contract with a local board of education comply with Tennessee Public Chapter #587 (TPC587).

TPC587 requires persons, employees of the person or corporation that have direct contact with school children or access to school grounds when children are present to have supplied to the corporation a fingerprint sample and have conducted a criminal history records check by the Tennessee Bureau of Investigation and the Federal Bureau of Investigation prior to permitting the person to have contact with such children or enter school grounds. (The Public Chapter 1080, (D) was amended to: “A person whose contract is for the performance of a service at a school-sponsored activity, assembly or even at which school officials or employees are present when the service is performed and where the activity, assembly, or event is *conducted under the supervision of school officials or employees.*”

TPC587 provides guidance for employees who have been convicted of an offense that is classified as a sexual offense or a violent sexual offense.

**I have read the attached TENNESSEE PUBLIC CHAPTER # 587 and certify compliance with the regulations.**

---

Name/Address of Organization

---

Name/Title of Submitting Official

---

Signature

---

Date

**BID BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

\_\_\_\_\_  
as Principal, and \_\_\_\_\_

as Surety, are hereby held and firmly bound unto Hamilton County Department of Education, Tennessee

as Owner in the penal sum of \_\_\_\_\_ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

The condition of the above obligated is such that whereas the Principal has submitted to Hamilton County Department of Education, Tennessee, a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing for the Project known as: BID 25-27, Control Updates at Bess T. Shephard

NOW, THEREFORE,

(a) If said Bid shall be rejected, or in the alternate.

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection herewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise shall remain in force and effect, it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Principal (L.S.)

By: \_\_\_\_\_

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

SEAL

Sealed Label - Affix this page to your sealed solicitation envelope to identify it as a "Sealed Submission/Proposal".

<b>BID/PROPOSAL DOCUMENTS • DO NOT OPEN</b>	
<b>SOLICITATION NO.:</b>	<b>25-27</b>
<b>SOLICITATION TITLE:</b>	<b>Control Updates at Bess T. Shepard</b>
<b>OPENING/DUE DATE:</b>	<b>April 22, 2025</b>
<b>TIME DUE:</b>	<b>Prior to: 2:00 PM</b>
<b>SUBMITTED BY:</b>	_____
	(Name of Company)
<b>e-mail address</b>	<b>Telephone</b>
<b>DELIVER TO:</b>	<b>Hamilton County Board of Education</b> <b>Attn: Purchasing Department</b> <b>3074 Claude Ramsey Parkway</b> <b>Chattanooga, TN 37421</b>

**CONTRACTOR LICENSING DETAILS**

Per TCA 62-6-119, it is necessary for Bidder to be properly licensed at the time of the bid and provide evidence of compliance with the applicable provisions of TCA 62-6-119 before such bid may be considered. As such the following licensure table shall be completed and affixed to the exterior of the Bidder's submission.

Provide TN state contractor license number, expiration date, and classification for Bidder and listed subcontractors as applicable. Provide name as listed on license.

<b><u>Prime Contractor</u></b>					
	Name	License Number	Expires	Classification	Address
Prime Contractor					

  

<b><u>Subcontractor(s)</u></b>					
	Name	License Number	Expires	Classification	License Required If Greater Than
Electrical					≥ \$25,000
Geothermal					≥ \$25,000
HVAC					≥ \$25,000
Masonry					≥ \$100,000
Plumbing					≥ \$25,000
Roofing					≥ \$25,000

**\*Notices:**

- The Date Due/Submission Deadline Date/Opening Date as stated on this label and other forms contained herein may have been updated via issuance of Addenda against this project. It is the sole responsibility of the Contractor/Vendor to monitor the HCS solicitation for any updates to the Date Due/Submission Deadline Date/Opening Date via Addenda. This label or other original forms may not be updated. Contractor/Vendor may strike through and update Date Due/Submission Deadline Date/Opening Date at their discretion to match any updates to this date that have been published via Addenda.
- Submissions received after the time and date of the Date Due/Submission Deadline Date/Opening Date will not be accepted at the sole discretion of HCS.
- Some submissions may require the Vendor to provide the company name, Tennessee Contractor's license number, expiration date, license classification and company address on the outside of the sealed bid envelope in accordance with TCA 62-6-119. Where this is requested within the project documents the Vendor is solely responsible for compliance with this request.
- Please print clearly.

**SECTION 23 01 02 - HVAC MECHANICAL AND ELECTRICAL COORDINATION****PART 1 - GENERAL:****1. RELATED DOCUMENTS:**

- A. Refer to Section 23 05 01 – General Requirements for Mechanical Work.

**2. SUMMARY:**

- A. This Section describes the coordination between the Mechanical and Electrical portions of the work.
- B. This Section is included under the Electrical portion of the specifications as Section 26 01 00.

**3. WORK INCLUDED:**

- A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
1. Equipment Motors	23	23	26
2. Magnetic Motor Starters:			
a. Automatically controlled, with or without HOA switches	23	23	Notes 1,3
b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	23	23	Notes 1,2
c. Manually controlled	23	23	Notes 1,3
d. Manually controlled and furnished as part of factory wired equipment	23	23	Notes 1,3
e. Furnished in Motor Control Centers	26	26	Notes 1,3
3. Line voltage thermostats, time clocks etc., not connected to control panel systems.	23	26	26

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
4. Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	23	23	23
5. Temperature control panels and time switches mounted on temperature control panels.	23	23	23
6. Motorized valves, motorized dampers solenoid valves, EP and PE switches, etc.	23	23	23
7. Alarm bells furnished with equipment installed by Division 15.	23	23	23
8. Wiring to obtain power for control circuits, including circuit breaker.	26	26	26
9. Low voltage controls, thermostats valves, dampers, etc.	23	23	23
10. Fire protection system (sprinkler) controls.	21	21	21
11. Fire and smoke detectors installed on mechanical units and in ductwork.	26	23	Note 2
12. All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment.	23	23	23
13. Pushbutton stations, pilot lights	23	23	23
14. Disconnect switches, manual operating switches furnished as a part of the equipment.	23	23	Note 1
15. Disconnect switches, manual operating switches furnished separate from equipment.	26	26	26
16. Multi-speed switches	23	23	26
17. Thermal overloads	23	23	23

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
18. Control relays, transformers	23	23	23
19. Tamper switches for fire protection (sprinkler) system.	21	21	26
20. Flow switches for fire protection (sprinkler) system.	21	21	26
21. Alarm bells or horns for fire protection (sprinkler) system.	21	21	26
22. Underground fuel tank leak detection and monitoring system.	23	23	23

## NOTES:

- (1) Power wiring as defined in Section 26 05 13 of the specifications shall be under Division 26; control wiring as defined in Section 26 05 13 of the specifications shall be under Division 23.
  - (2) Wiring from alarm contacts to alarm system by Division 16; wiring from auxiliary contacts to air handling system controls by Division 15. Division 16 shall provide power to smoke detector. Smoke detectors required for supply duct and return air duct for all air handling systems 2000 CFM or greater. Refer to other Division specifications and drawings for more specific requirements.
  - (3) For requirements for Magnetic Motor Starters, refer to Division 23, Section 23 05 01 – Mechanical General Provisions.
  - (4) Disconnect switches, operating switches, starters and other similar items, which are factory-mounted as a part of a complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
- B. Connections: Make all connections to controls, which are directly attached to ducts, piping and mechanical equipment with flexible connections.
- C. Precedence:
1. In general, piping systems, which require a stated grade for proper operation, shall have precedence over systems.
  2. Precedence for pipe, conduit and duct systems shall be as follows:
    - a. Building lines
    - b. Structural members
    - c. Soil and drain piping
    - d. Vent piping
    - e. Refrigerant piping
    - f. Condensate piping
    - g. Supply ductwork
    - h. Exhaust ductwork
    - i. Automatic fire protection sprinkler piping

- j. Domestic hot and cold water piping
  - k. Natural gas piping
  - l. Electrical conduit
3. Lighting fixtures shall have precedence over air grilles and diffusers.

D. Final Inspection and Report:

At the completion of the work, there shall be a meeting of the mechanical, electrical and temperature control contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies, which they represent, shall be filed with the Owner and Architect/Engineer.

**END OF SECTION 23 01 02**

## SECTION 23 01 03 - COMPLETION ITEMS

### PART 1 - GENERAL:

#### 1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

#### 1.2 CONNECTION TO EQUIPMENT:

- A. Work shall include all labor, material, equipment, etc. required including, but not limited to, the following: (1) condensing water supply and return, heating hot water supply and return, refrigerant piping, domestic hot and cold water supply, drain, vent, gas, etc., and (2) connections to all equipment specified in this or other sections requiring such services.
- B. Indicated locations and sizes of equipment connections are approximate; exact locations and sizes of piping, valves, etc. shall conform to approved shop drawings. Connection sizes shall not be smaller than scheduled size or equipment outlet size, whichever is larger.
- C. Equipment furnished by other sections shall be properly equipped structurally and mechanically with all accessories, including plumbing, piping, drains, traps, tailpieces, supply fittings, ductwork, gas lines, etc., internal to and part of the equipment installed by the equipment manufacturer or supplier, ready to receive single connections for each of the various mechanical items, except that this Division shall furnish shut-off valves and unions or flanges.
- D. Verify all connections and rough-in locations with the Architect and/or the equipment supplier or contractor prior to the start of their work.

#### 1.3 ADJUSTING AND TESTING:

- A. Before testing, protect from damage any control and indicating devices, etc. not designed to stand test pressures. Test all elements before covering or "closing in".
- B. Provide labor, material, instruments, fuel, electricity, water and other costs in connection with all tests. Installed instruments may be used for tests if calibrated and approved for the purpose.
- C. Conduct pressure, temperature, ampere, voltage, performance and operating tests for each system, equipment, unit motor, etc. as directed by and in presence of Engineer. Submit tabulation showing: (1) nameplate amperes and voltages, (2) actual full-load amperes and voltage for each phase of every motor, (3) overload element number and rating, (4) CFM for each air intake and outlet including O.A. and exhaust with actual reading obtained, (5) each fan RPM, (6) static pressures entering and leaving each fan, (7) water pressures in and out of each pump and, (8) water flow at each pump. See Section 23 05 93 for additional test and balance requirements.
- D. Test all piping, except refrigeration, air and oil, hydrostatically to 1.5 times maximum working pressure, but in no case less than 125 PSIG, for at least 4 hours. Subject welded joints to hammer test while under pressure. Caulking or peening repairs not permitted.

- E. Obtain certificates of approval, acceptance and compliance with regulations from agencies having jurisdiction.

## **PART 2 - PRODUCTS:**

### **2.1 RECORD AND AS-BUILT DOCUMENTS:**

- A. Maintain at job site a set of contract record documents kept current by indicating thereon all changes, substitutions, etc. between work as specified and as installed.
- B. Furnish Engineer one (1) complete set of reproducible mylar record drawings and electronic drawing files showing installed location, size, etc. of all work and material.
- C. Show on record documents actual air quantities, water flow rates, valve or damper positions after balancing, etc.; also show, by actual dimension, location of all underground work.
- D. For each piece of equipment, provide the owner three (3) sets of: (1) manufacturer's printed catalog pages, operating and maintenance instructions, wiring and connection diagram, etc., (2) temperature-humidity and motor interlock control and wiring diagrams showing operation instructions for, and normal position of, each motor and controller, control valve, thermostat, etc., and (3) lubrication chart. Bind this information into 8-1/2" x 11" booklets. All three (3) sets shall be assembled in hardback binders.

## **PART 3 - EXECUTION:**

### **3.1 OPERATING INSTRUCTIONS:**

- A. Furnish to the Architect written operating and maintenance instructions for each system and each piece of equipment. Include in equipment data binder specified above: (1) instructions to start and stop each piece of equipment, (2) itemized maintenance schedule, (3) submittals.
- B. When systems are completely adjusted, furnish personnel for five (5) full days to instruct Owner's operators. When Owner operates on a 24-hour basis, each shift shall be properly trained.

### **3.2 CLEANING AND FLUSHING:**

- A. Fixtures, Equipment, Etc.
  - 1. Fixtures, piping, ducts, equipment, etc. shall be cleaned per manufacturer's printed instructions and Engineer's instructions.
  - 2. No air unit shall be operated without a construction set of specified type filters being installed.
- B. Before final building interior finish is applied:
  - 1. Interior of air handling equipment shall be thoroughly cleaned.
  - 2. Drain pans shall be cleaned and then flushed with water after which, run all fans with air terminals out, put filters in place for 24 hours.

## C. Clean-Up of Piping:

1. Piping shall be: (1) flushed with clean water, (2) "blown out" with steam or compressed air, or (3) "swabbed out" as required, except where specified otherwise. All temporary connections required for flushing shall be provided and subsequently removed by the Contractor.
2. Care shall be exercised by contractor to prevent any other foreign matter from entering pipe or components of system during construction. Plug pipe ends or cover with burlap, or other material to keep out foreign materials. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt or other foreign matter removed.
3. Connect all equipment with fine mesh strainer in place and spools to bypass coil in fan coil units to prevent foreign matter from entering coils. With system filled, trapped air vented, check system to determine that no leaks exist. Any leaks in piping shall be repaired before proceeding. Pipe shall be opened at lowest points and highest points for initial flush and blow down, making sure makeup water fill valves are set to make up water at same rate of drainage. Check pressure gauge at pump suction and manually adjust makeup to hold same steady positive pressure before and after opening drain. Flushing shall continue until water is clean after opening drain points. In no case shall flushing period be less than two (2) hours. Provide temporary hoses on pipes as necessary to thoroughly flush all parts of system. Drain system.

## D. System Start-up Cleaning and Flush:

1. Fill system at city water makeup connection, with all air vents open. After filling with air vented, vents shall be closed.
2. Start pump with pressure reducing valve set for test pressure or for maximum for pump casing whichever is smaller. Vents shall be checked in sequence to bleed off any trapped air until there is circulation through all components of system. Open control valves in sequence for complete system circulation.
3. All vents shall be opened and pipe opened at valves and low points to completely drain system.
4. After system is drained it shall be refilled for operation under closed conditions. Contractor shall add a chemical cleanup solution to the system, the pump started, trapped air vents, drains closed, and control valves opened. Solution shall circulate for approximately 24 hours. Mechanical Engineer shall be given notice of this cleaning operation and will be present to observe the cleaning operation. If the engineer deems it necessary, the cleaning operation shall be repeated.
5. After system cleanout is completed, drain system and install flow control devices, coarse mesh strainers and connections to all coils. The fine mesh strainers at the pumps shall be removed and coarse mesh strainers installed. Refill system and make ready for operation and operating water treatment.

**3.3 PAINTING:**

- A. All equipment shall present a clean, painted appearance; touch-up, or repair, as required.
- B. All gas piping above ground, in or out of building, concealed or exposed, shall be painted yellow.
- C. Paint all equipment and other ferrous metal, which is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic #50. Clean thoroughly all surfaces before painting.

- D. Where ductwork can be seen through grilles, louvers, etc. paint the visible areas with flat black paint.

### 3.4 IDENTIFICATION:

- A. Identify all pipe by providing colored pipe markers, identifying the piping using flow arrows and colored bands: (1) in all accessible locations at 20 ft. intervals, (2) at each valve, (3) at each branch takeoff point, and (4) where a pipe leaves or enters a wall or floor so that lines may be traced from start to finish. **PIPE LABELS AND BANDS SHALL BE SNAP ON OR STRAP ON "SETMARK" AS MANUFACTURED BY SETON NAME PLATE CORPORATION, NEW HAVEN, CONNECTICUT 06519**, or approved equivalent meeting this level of quality. Identification colors, legend, letter sizes shall conform to ANSI and/or OSHA specifications.
- B. Identify all major items of equipment, including control panels and associated starters, switches, relays, etc. by 2-1/2" x 3/4" metal nameplates. Secure with screws or brads, adhesives alone  
  
are not acceptable. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.
- C. Identify location of outside underground piping by: 4"x4"x18" concrete stakes, flush with finish grade, located above lines at ends and/or corners, and by 2"x2" brass plates imbedded in building walls above pipes. On stakes provide plate secured to post indicating size and type of line below, along with depth of pipe below grade.
- D. Contractor shall mark the location of each duct smoke detector and all fire dampers. The mark shall consist of red marking tape acceptable to the Architect location on the ceiling grid at the location of each device.

### 3.5 LUBRICATION:

- A. During construction, all bearings and shafts shall be kept thoroughly greased and protected. All rotating equipment (fans, pumps, etc.) shall be turned by hand or by "bumping" the starter at least once a week during construction.
- B. After equipment has been operated seven (7) days and before final acceptance, all bearings shall be inspected and filled to operating level.

### 3.6 TESTING AND BALANCING AIR DISTRIBUTION & HYDRONIC SYSTEMS:

- A. See Section 15990.

### 3.7 QUIETNESS OF OPERATION:

- A. Pumps, fans, motors and other apparatus shall be selected and installed for reasonably quiet operation. Any objectionable noise, which develops, shall be corrected before the work will be accepted. Equipment, which produces objectionable noise, shall be adjusted or insulated so as to eliminate the noise, or shall be removed and replaced by satisfactory equipment. Provide spring or rubber machine mounting isolators and flexible piping and duct connections where necessary to prevent transmission of vibration to building structure or to piping and duct system. Refer to Section 15242 for requirements and type.

END OF SECTION 23 01 03

**SECTION 23 01 04 - GUARANTEE AND WARRANTY****PART 1 - GENERAL:****1.1 WORK DESCRIPTION:**

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

- 1.2 TEST PERIOD:** Each piece of equipment shall meet performance specifications after one (1) year's actual operation.

**PART 2 - PRODUCTS:**

Not used.

**PART 3 - EXECUTION:**

- 3.1** The Contractor shall replace, or make good, any defect due to faulty workmanship or material, which shall develop within one (1) year from date of acceptance at no cost of Owner. This guarantee shall cover both material and labor and shall include: (1) refrigerant and oil replacement, (2) any adjustments or service required, and (3) any necessary adjustments in system control set points when required, but no filter maintenance. The Contractor is responsible to replace work found not in conformance with the contract at any time during the life of the installation. Replacement of non-conforming work is not subject to the one-year warranty limitation.
- 3.2** Date of Acceptance shall be certified by the Engineer as that date on which the contract has been satisfactorily completed in accord with Contract Documents. If a whole or partial system, or equipment is put into use for benefit of any party, other than contractor and with prior written permission of the Owner, this agreed date shall become the "Date of Acceptance" for that piece of equipment or system.
- 3.3** **CERTIFICATE:** Prior to completion and final acceptance of the facility, furnish to the Engineer certification that the mechanical systems have been tested and that the installation and performance of those systems conform to the Contract Documents.
- 3.4** See other sections for additional warranty requirements.

**END OF SECTION 23 01 04**

## SECTION 23 01 05 - BASIC MATERIALS AND METHODS

### PART 1 - GENERAL:

#### 1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

### PART 2 - PRODUCTS:

#### 2.1 ELECTRICAL EQUIPMENT:

- A. Motor controllers, protective devices, etc. for control and protection of equipment shall be furnished with the equipment, but installed and electrically connected to power source under Division 26.
- B. NEMA Standards shall be taken as a minimum requirement for electrical equipment.
- C. Equipment shall operate properly under a 10% plus or minus voltage variation, and a 5% plus or minus frequency variation.
- D. Unless noted otherwise, motors shall be squirrel-cage induction type with ball bearings. Motors 1/2 HP and smaller shall be 120 volts, single phase with permanently lubricated bearings; 3/4 HP and larger shall be 3 phase, general purpose, Design "B" or "C", drip proof type. Verify characteristics of available current at the building before equipment is ordered.
- E. Motor shall be in accordance with IEE, UL and NEMA Standards, non-radio interfering type, rated for continuous, full-load duty and capable of withstanding momentary overloads of 50%. Select motors so actual loads does not exceed nameplate rating, and does not use motor "service factor". "Open" motors shall be rated 40 degrees C.; "totally enclosed" type shall be 50-degrees C. rated. Motors over 5 HP shall be "high efficiency" type and so labeled, and in compliance with NEMA MG-1 Standards. Service factor for motors shall be 1.15.
- F. Provide both overload and under-voltage protection in all phases.
- G. Except where interlock or automatic control is required, single speed motors, 1/2 HP and smaller have manual switch with pilot light and thermal overload protection.
- H. For manual operation of 3/4 HP and larger motors, furnish magnetic starter with:
  - 1. Maintained contact PB and pilot light or momentary contact pushbutton station and pilot light.
  - 2. Trip free, thermal overload relays.
  - 3. Capable of accepting electrical interlocks.
- I. Where interlock or automatic operation is specified, regardless of HP, provide magnetic starter complete with "RUN/OFF/AUTO" switch so connected that in "RUN" or "AUTO" all safety controls shall stop the motor.
- J. All magnetic starters shall have control circuits individually fused from line side of starter, or load

side of breaker. All starters on service 200 volts and above shall have 120 volt, built-in control circuit transformer fused on line and load side.

- K. Provide dual element fused disconnect for all hermetic motors above 3/4 HP.
- L. Heating Equipment: 1.8 KW and smaller, 120 volts; 1.81 KW through 4.7 KW, single phase; 4.8 KW and larger, 3 phase, voltage as noted or unless noted otherwise.
- M. Contactors shall be UL listed for 100,000 cycles of operation.
- N. Normal operation pilot lights shall be green; emergency condition signal lights shall be red.

## **2.2 EQUIPMENT ACCESSORIES:**

- A. Provide removable guards to enclose all rotating or moving elements. Construct of galvanized steel to withstand 250 lbs. static load. Provide tachometer access to shaft ends.
- B. Design V-belt drives for overload per belt manufacturer's recommendations, but in no case less than 150% of motor horsepower.
- C. Note that fixed speed drives are specified. If final tests, under operating conditions, indicate the need for a different speed drive to accomplish the required load at the least power requirements, the Contractor shall provide the required drive changes at no extra cost.
- D. On direct-coupled drive equipment, dowel motor and driven equipment to a common base using 2 dowels each.

## **2.3 ACCESS PANELS:**

- A. Provide access panels, or doors, at concealed dampers, valves, shock absorbers, vents, traps, trap primers, inspection points, etc. and where noted. Panels shall be galvanized steel, 16 gauge frame, 14 gauge door with mounting accessories, spring hinges, screwdriver operated lock, and prime coat paint. Milcor "A" for acoustic tile, "M" for exposed masonry, "K" for plaster finishes, stainless steel for ceramic, or glazed structural tile. Where ceiling is "lift out" construction, ceiling access panels are not required. Panels shall be 18" x 18" or larger, as required for service intended.
- B. Access doors giving access to "live" electrical gear shall have switch to cut off power when opened.
- C. Access panels in fire rated construction shall have a UL label, Class B rating.

**2.4 ROOF MOUNTED EQUIPMENT:** All roof-mounted equipment shall be furnished with a roof curb designed for flashing to roof and so designed to meet roof slope and make equipment level. Roof curbs shall be designed for Seismic Zone 2 and have an "R" rating from the state of California.

**2.5 CONCRETE:** Where required for pipe system encasement, equipment bases, etc. for Division 15, provide 3,000-PSI concrete.

**PART 3 - EXECUTION:****3.1 ELECTRICAL WORK:**

- A. All electrical work shall be provided under "Electrical Division", except: that associated with Division 23, (1) that associated with interlock circuits, (2) control circuits, (3) temperature-humidity controls. For these excepted items, this division shall provide conduit, wiring, connections, etc. as required for a complete control installation.
- B. The work under this Division shall be of the same type and quality as specified under "Electrical Division".

**3.2 EXCAVATION, SHORING AND BACKFILL:**

- A. Provide any excavation required for this Division below that is needed for general construction. Unless specifically noted, no extra shall be paid if rock or excavation difficulties are encountered.
- B. Provide separate trench for each utility.
- C. Provide: (1) bracing, shoring, etc. to protect sides of excavation, (2) staging, suitable ladders, barricades, etc. Comply with local regulations, or absence thereof with Division of the Manual of Accident Prevention provided for in Construction of the AGC.
- D. When trench excavation is required to cross traffic areas, one-half of the traveled portion of the pavement must remain open to traffic at all times, unless a plan approved by the City Traffic Engineer permits otherwise.
- E. Existing pavements, bases, curbs and gutters and sidewalks shall be cut and brought to a straight, vertical edge by mechanically sawing. Expansion joints removed shall be replaced.
- F. Maximum trench width is as shown on plans or 1.5 feet + O.D. of pipe or cable.
- G. Minimum trench width shall be sufficient to permit thorough compaction of the bedding material under and around the pipe or cable.
- H. All soft or otherwise unsuitable material shall be removed from the trench bottom and replaced with compacted crushed stone or other approved material.
- I. Bedding materials shall be the superior of class shown on approved plans or clean washed stone of 3/4-inch maximum particle size. Bedding shall provide a minimum of 6-inches cover above the pipe or cable unless otherwise shown on approved plans. Stone shall be brought up evenly on both sides of the pipe in 6-inch layers and tamped, rodded, or vibrated as required to provide a firm base and bedding around the pipe or cable.
- J. Remove all timber before backfilling. Backfill simultaneously on both sides of tanks, piping, etc. Backfill material shall be approved clay or chert, free of debris, rock larger than 1"Ø or other harmful material.
- K. All backfilling shall be compacted to 90% under sidewalks, or grass areas, and to 95% when under paved areas, structures, building slabs, and steps. etc. These percentages refer to "Percent of Maximum Density" per ASTM #D-1557. If more stringent, compact backfill to a dry density equal to that required by G.C.

- L. Backfill material for utility cuts in City of Chattanooga Streets and extending 18 inches beyond edge of pavement or back of curb shall be mineral aggregate, class "A", grading "D", (previously "33P", or "pugmix") in accordance with TDOT specification. This backfill material shall be placed and compacted in 6-inch layers by means of a mechanical tamp to a density not less than 83 percent of the solid volume density as determined from the bulk specific gravity and the dry weight of the aggregate. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content.
- M. Pavement shall be replaced in kind as shown on the city's standard drawings. The patch shall be finished so as to not leave a bump or dip in the finish grade.
- N. If permanent pavement repairs cannot be made within (2) days, then temporary replacement shall be made with 2-inches cold mix or hot bituminous seal coat. Permanent repair MUST be made within 10 workdays from date of pavement cut.
- O. Whenever trench openings are within state highways, the permit holder shall comply with all requirements and provisions of the Standard Method of the Tennessee Department of Transportation for opening trenches through highways and replacing pavements. All such work shall be subject to inspection and approval by the Tennessee Department of Transportation and/or the City of Chattanooga.
- P. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged in connection with work.
- Q. For insulated piping below grade, provide a bed of 6" sand minimum. After the insulation finish has cured, backfill with sand around the installation and over the insulation to a minimum of 6".

### **3.3** CUTTING AND PATCHING:

- A. Provide all cutting, patching, etc. incident to this work.
- B. Do not cut into any structural element without written approval of Engineer.
- C. Patching shall be: (1) of quality equal to, and of appearance matching existing construction, and (2) shall restore all services and construction which remains in use to its condition prior to this contract, unless otherwise noted.

### **3.4** **PIPING THRU RATED WALLS AND FLOORS:**

- A. Insulation on pipe passing thru fire rated walls must stop at pipe sleeve. Space between metal pipe and sleeve shall be protected with 3M Fire Barrier Penetration Sealing System or approved substitute. Installation shall be in accordance with the manufacturers recommendations for the hourly fire rating of the partition. The system shall be U.L. listed. Maintain vapor barrier on insulated chilled water and refrigerant suction piping.
- B. HDPE pipe passing through rated walls or floors shall have 3M UL modified fire protection system.
- C. Refer to details on drawing for pipe and duct penetration thru rated walls and floors.

**3.5 FLASHING:**

- A. Where pipes, ducts, etc. pass through roof, flash per drawing details. Where no detail is shown, use National Roofing Contractors Association Details.
- B. Locate pipes, ducts, etc. through roof to clear parapets, etc. by at least 18".
- C. Provide flashing or caulking as required at each opening through outside walls or roof. Flashing through roof of same materials and methods as under "Moisture Protection Division"; through walls shall be aluminum unless noted otherwise.
- D. Make roof drains and floor drains in upper floors, watertight with 4 lbs. per square foot sheet lead or polypropylene sheeting extending at least 12" from drain rim into membrane waterproofing and clamped to drain.
- E. Flashing shall provide watertight seal with 8" depth of water on roof.
- F. Where ducts pass through concrete floors, provide a 3" x 3" concrete curb with sheet metal cap flashing, when through roofs, provide a 3" x 12" high-insulated curb or pre-fabricated insulated roof curb.
- G. Where pipes pass through floor structures, other than slabs on grade, which floors contain a waterproofing membrane, provide a watertight floor sleeve for each pipe.
- H. Provide necessary curbs to receive flashing. See SMACNA Plate #65 and/or drawing details.
- I. Sheet lead shall be FS #QQ-L-201A.

**3.6 PROTECTION:**

- A. Work shall be protected at all times. Pipes openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

**3.7 TEMPORARY WORK:**

- A. Provide 3/4" water service with hose faucet 18" above grade located per instructions. Provide freeze protection. Upon completion of project: (1) close branch cock, (2) cap at point 18" below grade, (3) mark with concrete post.
- B. Water and electricity consumed during construction shall be paid for by General Contractor.

**END OF SECTION 23 01 05**

## SECTION 23 05 01 - HVAC MECHANICAL GENERAL PROVISIONS

### PART 1 - GENERAL:

#### 1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown or scheduled on the drawings.
- B. Equipment and materials used in the work shall be in accordance with the contract documents, of the best quality and grade for the use intended, shall be new and unused and shall be the manufacturer's latest standard or current model for which replacement parts are readily available.
- C. All apparatus and equipment shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations. All auxiliary piping, water seals, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

#### 1.2 SPECIAL CONDITIONS, MECHANICAL:

- A. By the act of submitting a bid, this Contractor agrees that all of the "Contract Documents" and each of the Divisions of the complete specifications have been reviewed and studied, and all requirements and coordination resulting there from are included.
- B. In this section, the word "Contractor" means the Mechanical Contractor. The word "provide" means furnish, install and connect.
- C. Do not scale drawings having 1/4" or smaller scale. Because of small scale, it is not possible to indicate all offsets, fittings, and accessories; provide such as are required for complete installation.
- D. The right is reserved to move any element as much as ten (10) feet at no increase in cost provided Contractor is notified before work in question is installed.
- E. Contractor shall be responsible for determining and verifying the characteristics of electrical current available to operate the mechanical equipment prior to ordering such equipment.
- F. Contractor shall be responsible for reviewing all drawings (Architectural, Mechanical, Electrical, Structural etc.). If any discrepancies are discovered between drawings, the contractor shall notify the Architect/Engineer prior to bidding so that an addendum may be issued for clarification.

#### 1.3 CODES AND STANDARDS:

- A. The intent is that the complete installation shall comply with applicable laws and ordinances, utility company regulations, and applicable requirements of the following:
  - 1. 2012 International: Building Code, Gas Code, Mechanical Code, and Plumbing Code.
  - 2. NFPA: National Fire Protection Association.
  - 3. National Plumbing Code

4. AGA: American Gas Association.
5. FM: Association of Factory Mutual Fire Insurance Company.
6. ASME: American Society of Mechanical Engineers.
7. ASTM: American Society of Testing Materials.
8. NSF: National Sanitary Foundation.
9. PDI: Plumbing Drainage Institute.
10. UL: Underwriters Laboratories.
11. NEC: National Electrical Code.
12. NEMA: National Electrical Manufacturer's Association.
13. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
14. ARI: American Refrigeration Institute.
15. PFMA: Power Fan Manufacturer's Association.
16. MSS: Manufacturer's Standard Society of Valve and Fittings Ind.
17. ANSI: American National Standard Institute.
18. API: American Petroleum Institute.
19. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
20. 2009 International Energy Code.
21. TOSHA: Tennessee Occupational Safety & Health Act.

#### **1.4 COORDINATION OF WORK:**

- A. Furnish and locate required anchor bolts, sleeves, inserts, supports, etc.
- B. Lines which pitch shall have right-of-way over lines whose elevations can be changed. Offsets, transitions and changes in direction in pipe and ducts shall be made as required to maintain proper headroom, pitch, etc.
- C. Coordinate all ducts, outlets, fixtures, etc. with floor, wall and ceiling patterns.
- D. The mechanical work shall be installed as neatly as possible in the locations shown but shall be subject to such deviations, modifications and relocations as may be necessary to conform to the requirements of the architectural drawings and as necessary to avoid interferences with the structural work and the work of other trades, and interferences between the various trades. This shall be done at no cost to the Owner. No ductwork, piping or equipment shall be installed which would require ceilings to be lower than required by drawings, unless approval is obtained from the Architect.
- E. If necessary to coordinate and expedite the work, the Contractor shall prepare "interference drawings" and submit them to the Architect for approval. Such drawings shall show the work of the various trades involved, illustrate proposed details of construction and arrangement of equipment and apparatus, and clearly indicate any deviations from contract requirements.
- F. Minor changes in arrangement may be made to suit unforeseen conditions, but no major deviation shall be made without written approval from the Architect. If any deviations are deemed necessary, submit all details of proposed changes and all reasons therefore, in writing, to the Architect for approval prior to making installation of such work.
- G. Contractor shall coordinate requirements for utility connections with municipal utility departments and utility companies. Installation of service taps, extensions, valves and metering provisions shall comply with criteria of appropriate authority, and any cost associated therewith shall be included in the bid amount.

## 1.5 DATA AND SHOP DRAWINGS:

- A. Prior to ordering, submit certified prints and/or descriptive data for major pieces of equipment, fixtures, valves, insulation, controls, etc. Stamp, sign and certify to be correct and in compliance with the Contract Documents, each drawing submitted for review. Drawing submitted without signed certification will be returned without review.
- B. Any deviation in submittal from contract documents of materials, capacities, space requirements in items furnished, etc. shall be listed in a letter accompanying submittal stating deviation and reason requested for consideration of acceptance.
- C. Submittals shall be bound in a 3 ring binder, clearly marked, and in order as indicated on drawings. Items submitted partially and in an unorganized manner shall be returned without review.
- D. Submittal shall show: manufacturer's catalog number, performance data with indicated operating points, finishes, optional features and modifications. Each sheet of printed submittal data shall be clearly marked (using arrows, underlining, or circling) to show the particular size, type, model number, ratings and options actually being proposed.
- E. When work in accordance with manufacturer's recommendation is specified, a copy of recommendations shall be kept in the job office.
- F. Furnish the number of copies required by the General and Special conditions of the contract but in no case less than six (6) copies.
- G. Shop drawings shall show sizes and details of required concrete and steel machine foundation, location of anchor bolts, physical dimension of equipment, equipment weight or other pertinent data required for equipment support or installation.
- H. Approved shop drawings do not mean that drawings have been checked in detail; said approval does not in any way relieve the contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings or specifications.

## PART 2 - PRODUCTS:

### 2.1 REFERENCE TO DRAWINGS:

- A. Reference shall be made to drawing schedules and details for: manufacturer, model, catalog number, size, capacity, performance, installation, etc. of equipment and material. Equipment of manufacturers other than those named, will be acceptable provided, in the opinion of the Engineer, it is of equal substance, function, performance and appearance.

### 2.2 CHOICE OF MATERIALS AND EQUIPMENT:

- A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimum and must be equaled, (2) physical size limitation for space allotted, (3) static and dynamic weight limitation (4) structural properties, (5) noise level, (6) vibration generation, (7) interchangeability, (8) accessibility for maintenance and replacement, (9) compatibility with other materials, assemblies, and (10) similar items shall be same manufacturer and style wherever possible.

- B. All material and equipment, for which a UL Standard, an AGA approval, or an ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted or otherwise obscured from visual inspection.
- C. Adhesives are not acceptable as a mounting, supporting, or assembling technique.
- D. Contractor shall pay any costs added to total contract as a result of any substitutions.
- E. Equipment, etc. shall not be purchased without Engineer's written approval.

### **PART 3 - EXECUTION:**

#### **3.1 DRAWINGS:**

- A. Drawings are diagrammatic. Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc. will fit in space provided, maintain headroom, and if in finished areas, be as neatly installed and "out-of-the-way" as physically possible. All equipment, piping, ductwork, conduits, etc., shall be installed to provide needed maintenance and passage space.

#### **3.2 FEES:**

- A. The contractor shall pay for fees and inspections as may be required for water and sanitary sewers, gas service, sprinkler systems, and all other systems requiring inspections by agencies having jurisdiction.

#### **3.3 INSPECTION OF SITE:**

- A. The drawings are prepared from the best information available and reflect the conditions commensurate with this information. However, the Contractor shall visit the site prior to submitting a proposal and shall verify the locations, sizes, depth, pressures, etc., of all existing utilities; and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, or the construction process, the Architect shall be notified in writing.
- B. All proposals shall take these existing conditions and any revisions required into account, and the lack of specific site information on the drawings shall not relieve the Contractor of his responsibility.

**END OF SECTION 23 05 01**

## SECTION 23 09 23 - DIRECT DIGITAL TEMPERATURE CONTROLS AND EMS

### PART 1 - GENERAL:

#### 1.1 OVERVIEW:

This document contains the specification, input/output summaries for a Direct Digital Control (DDC) system for Hamilton County Schools. The system architecture shall utilize intelligent distributed control modules, located at each site, which communicate to the Central Site computer. The existing Central Site computer is located at Hamilton County Schools Maintenance Department. The system shall provide the Direct Digital Control (DDC), Energy Management, and Building Automation for the air conditioning, lighting, heating and ventilating systems as shown on the drawings and as specified.

#### 1.2 INSTRUCTIONS TO BIDDERS:

- A. All DDC equipment shall be one of the following:
- B. Automated Logic System. All DDC control equipment shall be installed as specified by Automated Logic of Georgia (205) 577-9113, attention Phillip Brooker.
- C. Staefa Talon Master Controller and Delta BACnet Control System. All DDC control equipment shall be installed as specified by Electronic Controls, Inc. (423) 629-4014, attention Tim Buckner.
- D. All Mechanical Subcontractors are to secure their control price from one of the above vendors. No substitutes are allowed.

#### 1.3 SCOPE OF WORK:

- A. Contractor's Responsibilities:
  - 1. Controls Contractor shall furnish and install all necessary hardware, wiring, computing equipment and software as defined in this specification. Conduit stub outs within walls shall be furnished and installed under Division 26. In areas with cable tray, the Electrical Contractor shall in each classroom & lab provide a box with conduit stubbed out above ceiling & bushed. HVAC control cables will run in cable tray to EMS panels. In areas without cable tray, the Controls Contractor shall provide & install conduit from the sensor or control point location to the nearest EMS panel. Where an EMS panel is added beyond what is shown on the electrical drawings, the Controls Contractor shall provide & install a 1-1/4" conduit path to the nearest EMS panel.
  - 2. Controls Contractor shall provide one copy of their most recently updated controls software to be installed on the HCDE central site computer.
  - 3. Provide any upgrades as they become available during the course of the project to system software and install them to the Central system.
  - 4. All electrical wiring for this system shall be furnished and installed by this contractor and shall be of a uniform color throughout the installation.
  - 5. Contractor shall turn over to HCDE all existing control modules removed.
- B. System Requirements:
  - 1. All material and equipment used shall be standard components, regularly manufactured and available and not custom designed especially for this project. All systems and

- components, except site-specific software, shall have previously been thoroughly tested and proven in actual use prior to installation on this project.
2. The system architecture shall be fully modular permitting expansion of application software, system peripherals and field hardware.
  3. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.
- C. Products Furnished But Not Installed Under This Section:
1. Sensors and Transmitters:
    - a. Flow meters
    - b. Press and temp sensor wells & sockets
    - c. Temp sensor wells and sockets
  2. Control Valves:
    - a. Control valves
  3. Control Dampers:
    - b. Automated Dampers
- D. Air Terminal Units:
1. VAV boxes: VAV Terminal Units shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.
- E. Central HVAC Equipment:
1. Packaged AHU or evaporative cooler controls: Unit shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.
- F. Decentralized HVAC Equipment:
1. Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.
- G. Low-Voltage Controllers:
1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points specified. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by Modbus or BACnet. Start/stop and speed control to be hard wired.
- H. Communications with Third Party Equipment:
1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet or Modbus interface for integration into the Direct Digital Control System described in this section.

- I. Modbus System Intergration:
  1. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
  2. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
    - a. Read/Write Modbus AI Registers
    - b. Read/Write Modbus AO Registers
    - c. Read/Write Modbus BI Registers
    - d. Read/Write Modbus BO Registers
  3. All scheduling, alarming, logging, and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
  4. The BAS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

#### **1.4 CODES AND STANDARDS:**

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
  1. National Electric Code (NEC)
  2. International Building Code (IBC)
    - a. Section 719 Ducts and Air Transfer Openings
    - b. Section 907 Fire Alarm and Detection Systems
    - c. Section 909 Smoke Control Systems
    - d. Chapter 28 Mechanical
  3. International Mechanical Code (IMC)
  4. ANSI/ASHRAE 135-2004: Data Communication Protocol for Building Automation and Control Systems (BACnet)

- B. Manufacturer's Quality System:

The control system manufacturer shall be ISO9001 listed for design and manufacture of environmental control systems for precise control and comfort, indoor air quality, HVAC plant operation, energy savings and preventative maintenance. ISO Certification shall be by a registrar that is accredited by an internationally recognized organization such as RAB. Copy of ISO9001 certificate shall be submitted with bid.

- C. Conflict of Codes:

Where two or more codes conflict, the most restrictive shall apply. Nothing in this specification or related documentation shall be construed to permit work not conforming to applicable codes.

#### **1.5 GENERAL CONDITIONS:**

- A. Changes in Scope of Work:

Any changes in the scope of work must be authorized by a written Change Order.

**B. Correction of Work:**

1. Contractor's Responsibility.
  - a. The Contractor shall promptly correct all work Architect/Engineer finds defective or failing to conform to the Contract Documents. The Contractor shall bear all cost of correcting such work.
2. During Warranty.
  - a. If, within the warranty period required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from Architect/Engineer to do so. Architect/Engineer shall give notice promptly after discovery of the condition.

**C. Coordination of Work During Construction:**

1. The Contractor shall coordinate any necessary changes in work scheduling with Architect/Engineer to minimize disruption.
2. The Contractor shall protect the installed works by other trades.
3. The Contractor shall coordinate with other trades.
4. The Contractor shall repair any damage caused by his work to building(s) and equipment at no additional cost to the owner.

**D. Warranty**

Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

**1.6 SYSTEM PERFORMANCE:****A. Performance Standards**

System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display.
  - a. A graphic with 16 dynamic points shall display with current data within 10 sec.
2. Graphic Refresh.
  - a. A graphic with 16 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
3. Configuration and Tuning Screens.
  - a. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 seconds.
4. Object Command.
  - a. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time.
  - a. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency.
  - a. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance.
  - a. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation.
  - a. Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. Reporting Accuracy.
  - a. System shall report values with minimum end-to-end accuracy listed in Table
10. Control Stability and Accuracy.
 

Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

**Table 1**  
**Reporting Accuracy**

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15°C (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)

Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO <sub>2</sub> )	±50 ppm

**Note 1: Accuracy applies to 10% - 100% of scale**

**Note 2: For both absolute and differential pressure**

**Note 3: Not including utility-supplied meters**

**Table 2  
Control Stability and Accuracy**

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

## 1.7 SUBMITTALS, DOCUMENTATION, ACCEPTANCE AND TRAINING:

### A. Submittals:

1. Shop Drawings.
  - a. A minimum of six (6) copies of shop drawings shall be submitted and shall consist of a complete list of equipment, materials, manufacturer's technical literature, cut-sheets, and installation instructions. Drawings shall contain proposed layout, complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, installation details, and any other details required to demonstrate that the system will function properly.
2. Programming Documentation.
  - a. The Contractor shall provide a printout all Programs, identifying the specific HVAC or mechanical/electrical subsystem being controlled
3. Drawing Approval.
  - a. Shop drawings shall be approved before any equipment is installed. Controls contractor shall allow a minimum of fourteen (14) days for drawing approval.
4. As-Built Drawings.
  - a. All drawings shall be reviewed after the final system checkout and updated or corrected to provide 'as-built' drawings to show exact installation. All shop drawings will be acknowledged in writing by Architect/Engineer before installation is started and again after the final checkout of the system. The system will not be considered complete until the 'as-built' drawings have received their final approval. The Contractor shall deliver six (6) sets of 'as-built' drawings.

### B. Documentation:

Operating and Maintenance (O&M) manuals for the system shall be made available electronically using Acrobat 4.x (PDF) format and include the following categories: Workstation User's Manual, Project Engineering Handbook, and Software Documentation.

1. BAS User's Manual shall contain as a minimum:
  - a. System overview
  - b. Networking concepts
  - c. Launching a web browser from a networked PC/PDA and login
  - d. Graphical User Interface (GUI) screen menus and their definitions
  - e. Creating, modifying or deleting schedules
  - f. Loading and downloading software to the field hardware
  - g. Creating historical trends, collecting trend data and generating trend graphs
  - h. Enabling and assigning alarms and messages to reporting actions/groups
  - i. Report generation and 'third party software'
  - j. Backing up software and data files
2. Project Engineering Manual shall contain as a minimum:
  - a. System architecture overview
  - b. Hardware cut-sheets and product descriptions.
  - c. The Contractor shall deliver six (6) sets of 'as-built' drawings. All drawings shall be reviewed after the final system checkout and updated to provide 'as-built' drawings. The system will not be considered complete until the 'as-built' drawings have received their final approval.
  - d. Installation, mounting and connection details for all field hardware and accessories
  - e. Commissioning, setup and backup procedures for all control modules/accessories, BAS server software, and database.
  - f. Listing of basic terminology, alarms/messages, error messages and frequently used commands or shortcuts.
3. BAS Software Documentation shall contain as a minimum:
  - a. The Contractor shall provide a printout all Programs, detailing their application to specific HVAC equipment and electrical/mechanical subsystems, together with a glossary or icon symbol library detailing the function of each graphical icon. Revisions made as a result of the submittal process, during the installation, start-up or acceptance portion of the project, shall be accurately reflected in the "as-builts".
  - b. Graphical representation of the mechanical equipment hierarchy for the project including all equipment controlled by the BAS. For example: a VAV terminal box may be the source for increased cooling demand and require the primary VAV AHU to operate which, in turn, requires the chillers to operate.
  - c. Detailed listing of all alarm and event messages programmed for designated mechanical/electrical equipment and required operator action.
4. Acceptance Test:
  - a. Acceptance Testing  
Upon completion of the installation, the Contractor shall start up the system and perform all necessary calibration, testing, and debugging operations. The Contractor in the presence of the Owner's representative shall perform an acceptance test.
  - b. Notice of Completion  
When the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, Architect/Engineer shall issue a "notice of completion" and the warranty period shall start.
5. System Training:  
System Use Instructions: Controls Contractor shall provide full Computer Based Training (CBT) in addition to training of designated personnel in the operation, maintenance, and programming of the system. Training shall be for 16 hours and coordinated with HCDE.

## PART 2 – PRODUCTS

### 2.1 MATERIALS:

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

### 2.2 COMMUNICATION:

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2004, BACnet. No exceptions acceptable.
- B. All database values (e.g., input /output objects and software are variables) of any one controller shall be readable and writeable by any other controller or third party BACnet capable device on the internetwork.
- C. Install new wiring and network devices as required to provide a complete and workable control network. Use existing Ethernet backbone for network segments marked "existing" on project drawings.
- D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
  - 1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
  - 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 15900 Part 5 Sequences of Operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- F. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. System shall automatically adjust for daylight saving and standard time.
- G. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.
- H. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.
  - 1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.

2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.
4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

## 2.3 OPERATOR INTERFACE:

### A. Operator Interface.

Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. As a minimum, the following capabilities shall be provided through this interface:

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.
2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

### B. Communication.

Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135-2004, BACnet Annex J.

### C. Hardware.

Each or web server (embedded or server-based) shall consist of one of the following:

1. Server Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications. Hard disk shall have sufficient memory to store system software, one year of data for trended points specified in Sequences of Operation, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Server shall be IBM-compatible PCs with a minimum of:
  - a. 266 Gha processor
  - b. 2 GB RAM
  - c. 100 GB hard disk providing data at 100 MB/sec
  - d. 48x CD-ROM drive

Minimum 4 USB ports, parallel, and network communication ports and cables required for proper system operation.

2. Embedded Base.
  - a. 250 MHz processor
  - b. 64 MB RAM and 64 MB serial flash
  - c. Ethernet ports - 10/100
  - d. one RS 232
  - e. one RS 485
  - f. Battery backup
  - g. Real time clock

D. Operator Functions.

Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out  
System shall require user name and password to log in to operator interface.
2. Point-and-click Navigation  
Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
3. View and Adjust Equipment Properties  
Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
4. View and Adjust Operating Schedules  
Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
5. View and Respond to Alarms  
Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
6. View and Configure Trends  
Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
7. View and Configure Reports  
Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest. Operators shall be able to schedule 'standard' or 'custom' reports and automatically email reports based on occurrence of an 'event' or 'schedule'. Reports shall be sent in Microsoft Excel, Acrobat or CSV format.
8. Manage Control System Hardware  
Operators shall be able to view controller status, to restart (reboot) each controller, download new control operating firmware, re-configure control sequence(s) and download to designated controller(s) via the web browser or network.

9. Manage Operator Access  
Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software:

1. Operating System  
Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, Sun Solaris, or QNXRTOS, IBM J9 JVM, Niagara.
2. System Graphics  
Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
  - a. Functionality  
Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
  - b. Animation  
Graphics shall be able to animate by displaying different image files for changed object status.
  - c. Alarm Indication  
Indicate areas or equipment in an alarm condition using color or other visual indicator.
  - d. Format  
Images shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X, Java and Macromedia Flash).

F. System Tools

System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration  
Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
2. Controller Memory Download  
Operators shall be able to download memory from the system database to each controller.
3. System Configuration  
Operators shall be able to configure the system.

4. Online Help  
Context-sensitive online help for each tool shall assist operators in operating and editing the system.
5. Security  
System shall require a user name and password to view, edit, add, or delete data.
  - a. Operator Access  
Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
  - b. Automatic Log Out  
Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.
  - c. Encrypted Security Data  
Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
6. System Diagnostics  
System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
7. Alarm Processing  
System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Sequences of Operation.
8. Alarm Messages  
Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
9. Alarm Reactions  
Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate. The send e-mail alarm action should be able to run a report and attach it to the e-mail. The e-mail should use SSL to secure the communications between the system server and the mail server. Operator shall also be able to set the following conditions for an alarm action:
  - a. Run the alarm action only when the alarm source generates an alarm or when it returns to normal.
  - b. Wait a specified amount of time, then run the alarm action if the alarm has not been acknowledged or has not returned to normal.
  - c. Run if the alarm occurs during the occupied hours defined for a schedule group of run if the alarm occurs during the group's unoccupied hours.
10. Alarm Maintenance  
Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
11. Trend Configuration  
Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Sequences of Operation.
12. Object and Property Status and Control  
Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs  
Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
14. Standard Reports  
Furnish the following standard system reports:
  - a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
  - b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
  - c. Logs  
System shall log the following to a database or text file and shall retain data for an adjustable period:
    - i. Alarm History
    - ii. Trend Data  
Operator shall be able to select trends to be logged.
    - iii. Operator Activity  
At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.
15. Custom Reports  
Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.
16. Graphics Generation  
Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.
17. Graphics Library  
Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.
18. Custom Application Programming  
Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
  - a. Language  
Language shall be graphically based and shall use function blocks or GCL line programming arranged in a logic diagram that clearly shows control logic flow. Function blocks or GCL line programming shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.
  - b. Programming Environment  
Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.
  - c. Independent Program Modules  
Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
  - d. Debugging and Simulation

Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements

Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions

Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables:

Operator shall be able to use variable values in program conditional statements and mathematical functions.

i. Time Variables

Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

ii. System Variables

Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

## 2.4 CONTROLLER SOFTWARE:

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling

System shall provide the following schedule options as a minimum:

1. Weekly

Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception

Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.

3. Holiday

Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

C. System Coordination

Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

## D. Remote Communication

System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

## E. Demand Limiting

1. System shall monitor building power consumption from building power meter pulse generator signals or from building feeder line watt transducer or current transformer.
2. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in Sequences of Operation (Sequences of Operation). When demand drops below adjustable levels, system shall restore loads as specified.

## F. Maintenance Management

System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in Section 15900 Part 5 Sequences of Operation (Sequences of Operation).

## G. Sequencing

Application software shall sequence chillers, boilers, and pumps as specified in Sequences of Operation (Sequences of Operation).

## H. PID Control

System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

## I. Staggered Start

System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

## J. Energy Calculations.

1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

## K. Anti-Short Cycling

Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

## L. On and Off Control with Differential

System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

M. Runtime Totalization

System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Sequences of Operation (Sequence of Operations).

## 2.5 CONTROLLERS:

A. General

Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified in Section 15900 Article 1.9 (System Performance). Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. BACnet

1. Building Controllers (BCs)  
Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
2. Advanced Application Controllers (AACs)  
Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
3. Application Specific Controllers (ASCs)  
Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
4. Smart Actuators (SAs)  
Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.
5. Smart Sensors (SSs)  
Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
6. BACnet Communication
  - a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
  - b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
  - c. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
  - d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
  - e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

- f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

C. Communication

1. Service Port  
Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management  
BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing  
Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation  
Each piece of equipment specified in Section 15900 Part 5 Sequences of Operation shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

D. Environment

Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability

1. Controllers shall have diagnostic LEDs for power, communication, and processor.
2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory

1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

#### H. Immunity to Power and Noise

Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

#### I. Transformer

ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

## 2.6 INPUT AND OUTPUT INTERFACE:

#### A. General

Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

#### B. Protection

Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

#### C. Binary Inputs

Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

#### D. Pulse Accumulation Inputs

Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

#### E. Analog Inputs

Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

#### F. Binary Outputs

Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

#### G. Analog Outputs

Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch and status lights. Analog outputs shall not drift more than 0.4% of range annually.

#### H. Tri-State Outputs

Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

#### I. Universal Inputs and Outputs

Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

## 2.7 POWER SUPPLIED AND LINE FILTERING:

#### A. Power Supplies

Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
  - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
  - b. Line voltage units shall be UL recognized and CSA listed.

#### B. Power Line Filtering

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
  - a. Dielectric strength of 1000 V minimum
  - b. Response time of 10 nanoseconds or less
  - c. Transverse mode noise attenuation of 65 dB or greater
  - d. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

## 2.8 AUXILIARY CONTROL DEVICES:

#### A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:

1. Control dampers shall be parallel or opposed blade type as below or as scheduled on drawings.
  - a. Outdoor and/or return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct air-streams toward each other. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.
  - b. Other modulating dampers shall be opposed blade type.
  - c. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
2. Damper frames shall be 13 gauge galvanized steel channel or 1/8" extruded aluminum with reinforced corner bracing.

3. Damper blades shall not exceed 20 cm [8"] in width or 125 cm [48"] in length. Blades are to be suitable for medium velocity performance (10 m/s [2,000 fpm]). Blades shall be not less than 16 gauge.
4. Damper shaft bearings shall be as recommended by manufacturer for application, Oilite or better.
5. All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s·m<sup>2</sup> [10 cfm per sq. ft.] at 1000 Pa [4" w.c.] differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s [1,500 fpm].
6. Individual damper sections shall not be larger than 125 cm x 150 cm [48" x 60"]. Provide a minimum of one damper actuator per section.
7. Modulating dampers shall provide a linear flow characteristic where possible.
8. Dampers shall have exposed linkages.

B. Electric damper actuators.

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
2. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing.
3. All rotary spring-return actuators shall be capable of both clockwise and counter-clockwise spring-return operation. Linear actuators shall spring-return to the retracted position.
4. Proportional actuators shall accept a 0 to 10 VDC or 2 to 10vdc operating range.
5. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not require more than 11 VA.
6. All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N·m [60 in-lb] torque capacity shall have a manual crank for this purpose.
7. Actuators shall be provided with a raceway fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections
8. Actuators shall be UL Standard 873 Listed and CSA Class 4813 02 Certified as meeting correct safety requirements and recognized industry standards.
9. Actuators shall be designed for a minimum of 60,000 full-stroke cycles at the actuator's rated torque.
10. Actuators may be Siemens or Belimo.

C. Control valves.

1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.
2. Globe valves shall be used for modulating service, acceptable manufacturers are Siemens V599 series valves with SSB, SQX, or SKD actuators, or Honeywell V5860 valves with M6410 actuators, V501 and VGF2 valves with ML series actuators.
3. Full ported ball valves or butterfly valves shall be used for two-position or isolation service and shall be line size. Acceptable manufacturers of ball valves are Siemens 599 series with Siemens actuators or Delta Control Products Soft Touch valves with DC series actuators. Acceptable manufacturers of butterfly valves are Siemens BV series or Delta Control Products valves with DC or DCS actuators.
4. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

- a. Water Valves:
  - i. Two-way: 150% of total system (pump) head.
  - ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
5. Water Valves:
  - a. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
  - b. Sizing Criteria:
    - i. Two-position service: Line size.
    - ii. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35kPa [5 psi], whichever is greater
    - iii. Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa [5 psi] maximum.
    - iv. Valves ½" through 2" shall be bronze body or cast brass ANSI Class 250, spring-loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
    - v. 2½" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
  - c. Water valves shall fail normally open or closed as scheduled on plans, or as follows:
    - i. Water zone valves - normally open {preferred}.
    - ii. Heating coils in air handlers - normally open
    - iii. Chilled water control valves - normally closed.
    - iv. Other applications - as scheduled or as required by sequences of operation.
- D. Binary Temperature Devices.
  1. Low-voltage space thermostat shall be 24 V, bimetal-operated, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C [55°F to 85°F] setpoint range, 1°C [2°F] maximum differential, and vented ABS plastic cover.
  2. Line-voltage space thermostat shall be bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C [55°F to 85°F] setpoint range, 1°C [2°F] maximum differential, and vented ABS plastic cover.
  3. Low-limit thermostats. Low-limit thermostats shall be vapor pressure type with an element 6 m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any 30 cm [1 ft] section. The low-limit thermostat shall be manual reset only and be supplied as DPST.
- E. Temperature sensors.
  1. Temperature sensors shall be thermistors.
  2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5 m [5 feet] in length.
  3. Immersion sensors shall be provided with a separable brass well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
  4. Space sensors shall be equipped with the following:
    - a. 3-value, 96-segment LCD display when room humidity sensor is specified. Temp +/- 2°F, when humidity is not specified.
  5. Provide matched temperature sensors for differential temperature measurement.
- F. Humidity sensors.

1. Duct and room sensors shall have a sensing range of 20% to 80%.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C [-40°F to 170°F].
4. Humidity sensor's drift shall not exceed 3% of full scale per year.

G. Flow switches.

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
2. Paddle type switches (water service only) shall be UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.
3. Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as specified.

H. Relays.

1. Control relays shall be UL Listed plug-in type with dust cover or Functional Devices Relay In a box (RIB). Contact rating, configuration, and coil voltage suitable for application
2. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable  $\pm 200\%$  (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

I. Override timers.

1. Override timers shall be spring-wound line voltage UL Listed, contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified; suitable for flush mounting on control panel face, located on local control panels or where shown.

J. Current transmitters.

1. AC current transmitters shall be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0 – 5vdc two-wire output. Unit ranges shall be 70A, 60A and 120A full scale, internal zero and span adjustment, and  $\pm 1\%$  full scale accuracy at 500 ohm maximum burden
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation.
4. Current switches are not acceptable.

K. Current transformers.

1. AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for  $\pm 1\%$  accuracy at 5 A full scale output.
3. Transformers shall be split-core type for installation on new or existing wiring.

- L. Voltage transmitters.
1. AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
  2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with  $\pm 1\%$  full-scale accuracy with 500 ohm maximum burden.
  3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.
- M. Voltage transformers.
1. AC voltage transformers shall be UL/CSA recognized, 600 VAC rated, complete with built-in fuse protection.
  2. Transformers shall be suitable for ambient temperatures of 4 to 55°C [40 to 130°F] and shall provide  $\pm 0.5\%$  accuracy at 24 VAC and a 5 VA load.
  3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.
- N. Power monitors.
1. Power monitors shall be three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers and UL Listed split-core current transformers.
  2. Shall provide a selectable rate pulse output for kWh reading and a 1 –5vdc or 4 to 20 mA output for kW reading. Shall operate with 5 A current inputs with a maximum error of  $\pm 2\%$  at 1.0 power factor or  $\pm 2.5\%$  at 0.5 power factor.
- O. Pressure transducers.
1. Transducer shall have linear output signal. Zero and span shall be field-adjustable.
  2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage
  3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.
  4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.
- P. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.
- Q. Pressure-Electric (PE) Switches.
1. Shall be metal or neoprene diaphragm actuated, operating pressure rated 0–175 kPa [0–25 psig], with calibrated scale setpoint range of 14–125 kPa [2–18 psig] minimum, UL listed
  2. Provide one- or two-stage switch action SPDT, DPST, or DPDT, as required by application.
  3. Shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified
  4. Shall have a permanent indicating gauge on each pneumatic signal line to PE switches.

- R. Electro-pneumatic (E/P) transducers.
  - 1. Electronic/pneumatic transducer shall provide a proportional 20 to 100 kPa [3 to 15 psig] output signal from a 0 to 10 VDC analog control input.
- S. Local control panels.
  - 1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels.
  - 2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings
  - 3. Provide 120v receptacle at each local panel location.

### **PART 3 – INPUT/OUTPUT (I/O) SUMMARY**

- A. See attached.

### **PART 4 – EXECUTION**

#### **4.1 PREPARATION:**

Protection of Persons and Property:

- A. Safety Precautions and Programs. The Controls Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work.
- B. Safety of Persons and Property. The Controls Contractor shall take all reasonable precautions and provide all reasonable protection to prevent damage, injury or loss to:
  - 1. All employees on the installation sites and all other persons who may be affected.
  - 2. All work, materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Controls Contractor or any Subcontractor or Sub-contractor.
  - 3. Other property at the site or adjacent thereto. The Controls Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders or any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. It shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

#### **4.2 HARDWARE INSTALLATION:**

- A. Utility Company Equipment:
  - 1. Hamilton County Schools shall arrange installation of electric billing meters with demand signal pulses.

**B. Wiring:**

1. The Controls Contractor shall finish and install all communication wires to/from Control Modules.
2. The Controls Contractor shall install wires for the room temperature sensors (from sensor to the appropriate control module.)
3. The Controls Contractor shall install all sensing devices and the wiring to modules.
4. The Controls Contractor shall install all control and monitoring wiring.
5. Low voltage wire shall be not less than 22 AWG. All line voltage wire shall be THHN/TFFN. 600 volt rated.
6. All line voltage wire shall be run in conduit (EMT). All exposed wiring shall be run in conduit. Wiring in walls, mechanical rooms, fan rooms, above limited access ceilings, shall be run in conduit. All conduits shall be furnished and installed under Division 26. Plenum-rated wire run in accessible concealed areas may be run without conduit using gutters and wiring trays and when applicable, the owners wiring tray and wall penetrations. See electrical drawings and specifications. Accessible concealed wire run in return air plenums shall meet NEC 725 (b) code.
7. All electrical wiring for this system shall be furnished and installed by this contractor and shall be of a uniform color throughout the installation.
8. The Controls Contractor shall install the air purifications systems per Section 23 40 01.

**END OF SECTION 23 09 23**

## Hamilton County Department of Education

### Controls Upgrades at: Bess T. Shepherd Elementary School HC Project #25-27 C&A Project #25-005

### Attachment A Project Scope of Work & Points List

#### Bess T. Shepherd Elementary School Controls Scope of Work:

##### Current System & Project Summary:

1. Replace existing control system. Restore all existing points on the new controls system. New controls system shall be by Electronic Controls Inc. or Automated Logic only.
2. Provide all of the new controls, modules, field devices, and wiring for the school. Include all points as itemized on the attached points list included in this document. Include all items specifically required in the notes.
3. Turn over all existing controllers to HCDE.
4. Do not reuse any existing communications cabling. All existing communications cabling shall be replaced with new.

##### Boiler Room:

Replace controllers, temperature sensors, outside temperature / humidity sensors, loop changeover valves, hot water reset valve. The changeover valves shall be completely replaced including valves and actuators. New changeover valves and hot water reset valve to be VSI butterfly valves with series 1000X with actuators. Modify boiler piping to provide boiler return temperature control (RTC). Provide and install a 3-way modulating valve and a circulation pump for each of the two boilers.

Install a bypass/ decoupler loop in the boiler piping to allow the RTC to function properly.

Replace the loop pump starters with VFD,s.

Provide power to new circulation pumps and changeover valves.

Conduit is required in boiler room. No open cable allowed.

##### Points list:

###### Inputs:

Loop supply and return temperature  
Boiler-1 and 2 entering and leaving temperature  
Chiller leaving temperature  
Chiller amperage  
Outside temperature and humidity  
Changeover thermostat status  
Chilled water pump amperage  
Boiler-1 and 2 alarm status  
Hot water pump amperage  
Boiler-1 and 2 RTC valve position feedback  
Boiler-1 and 2 RTC pump amperage  
Loop changeover valve-1 and 2 position feedback  
Hot water reset valve position feedback

Outputs:

Loop pump-1 and 2 start stop  
Loop pump-1 and 2 VFD speed  
Loop changeover valve-1 and 2 control  
Boiler-1 and 2 start stop  
Boiler-1 and 2 RTC pump start stop  
Boiler-1 and 2 RTC valve control  
Chiller start stop  
Hot water reset valve control

**Unit Ventilators QTY-29:**

Replace controllers, temperature sensors, freezstats. Install new space temperature / humidity sensor. The CHW / HW valve actuators are to be replaced with new Siemens actuators to match the existing Siemens valve. Replace economizer damper actuator with Siemens GBB161.

Points list:

Inputs:

Space temperature  
Space humidity  
Supply air temperature  
Supply fan amperage  
Freezestat status  
Osa damper position feedback

Outputs:

Supply fan start stop  
CHW / HW valve control 0-10 vdc  
Economizer damper control 0-10 vdc

**AHU's QTY-2:**

Replace controllers, temperature sensors, freezstats. Install new space temperature / humidity sensor. Replace the CHW/HW valve complete including valve and actuator with Siemens 599 series. Replace economizer damper actuator with Siemens GCA161. Provide and install VFD for the supply fan. Convert units to single zone VAV control.

Points list:

Inputs:

Space temperature  
Space humidity  
Return air temperature  
Supply air temperature  
Mixed air temperature  
Supply fan amperage  
Freezstat status  
Valve position feedback  
Osa damper position feedback

Outputs:

Supply fan start stop  
Supply fan VFD speed control  
CHW / HW valve control  
Economizer damper control

**Cabinet Units CAC QTY-23:**

Provide and install Delta controllers, temperature sensors amperage sensors and freezstats. Install a new space temperature sensor. The existing CHW / HW valves and actuators are to be replaced with new Siemens 599 series valves and actuators. Replace the minimum OA damper actuator.

Points list:

Inputs:

Space temperature  
Supply air temperature  
Fan amperage  
Freezstat status (Qty-7)

Outputs:

Supply fan start/stop  
Duel temp control valve (0 to 10 vdc modulating)  
Minimum OA damper (Qty-7)

**RTU's QTY-7:**

Replace controllers, temperature sensors. Install new space temperature / humidity sensor. .

Points list:

Inputs:

Space temperature  
Space humidity  
Supply air temperature  
Supply fan amperage

Outputs:

Supply fan start stop  
Control two stages of DX cooling  
Control two stages of gas heat

**Miscellaneous Items:**

Inputs:

Freezer temperature  
Cooler temperature

Outputs:

Outside lights On/Off

**END OF CONTROLS PROJECT SCOPE OF WORK**