ADDENDUM NO. 2

DATE: December 28, 2018

ARCHITECT: Smolen, Emr, Ilkovitch Architects, Inc.
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OWNER: Howard County Public School System

PROJECT: Pointers Run Elementary School Systemic Renovation
Clarksville, Maryland
Architect Project No. 17015

TO: All Prospective Bidders

The following changes are made a part of the Drawings and Specifications for the subject project, dated October 10, 2018. Receipt of this Addendum is to be acknowledged, in the space provided in the Bid Form. Failure to do so may subject the Bid to be considered as non-responsive.

A. REQUESTS FOR INFORMATION *See Addendum #1 for RFIs 1 through 24*

25. In regard to this project, can the GC offer varying discounts based off of being awarded multiple projects? Or must the GC only offer 1 flat discount across all 4 of the Howard County HVAC Renovation projects.

    RESPONSE: Varying discounts are not being accepted for these projects. Any proposed discount is to be one flat discount for being awarded multiple projects, that will be applied to all projects awarded.

26. Who holds roof warranty?

    RESPONSE: See Addendum #1, response to Bid RFI 21.

27. Who is responsible for removal of roof units and roofing?

    RESPONSE: Contractor shall review spec. section 01 02 00.3.A.7, 3.B.12 and 3.C.14.

28. Who removes the unit heaters?

    RESPONSE: Contractor shall review spec. section 01 02 00.3.A.7, 3.B.12 and 3.C.14.

29. Who is responsible to supply testing and inspections - Steel, Concrete - GC or Owner?

    RESPONSE: Contractor shall Review Spec. Section 01 40 00

30. Detail E on S-301 calls for 71 enlarged openings?

    RESPONSE: See C/S3.01. Delete note referring to 71 enlarged openings at unit ventilators in E/S3.01.

31. Architectural and mechanical phasing plans do not match.

    RESPONSE: Sheet A0.05 will be revised in Addendum 2.

32. Drawing A-201 note 6 shows new casework. On drawing A-2.03 the same condition does not have a note 6 shown.

    RESPONSE: Countertop replacement over existing casework is only required where new cabinetry is provided at previous unit ventilator locations (Area C, sheet A2.03).

33. Pictures of existing conditions or as built drawings?

    RESPONSE: See Addendum # 1 for time available to visit the jobsite

34. Is the 1A contractor responsible for cutting the holes required for all the ductwork and piping through existing walls? If the 1A contractor will be responsible for this work we will need a floor plan showing the existing wall assemblies with any fire rated assemblies denoted.

    RESPONSE: Contractor shall review spec. section 01 20 00.3.A.32

35. Will the 15A contractor be responsible for the removal of the abandoned equipment to the dumpster or will the 1A contractor be responsible?

    RESPONSE: The 1A Contractor shall provide dumpsters for general trash for all contractors throughout construction. Each contractor is responsible for removal from site of their own demolition materials.

B. CHANGES TO SPECIFICATIONS

- ❑ 01 02 00 – Contract Packages
  - **REVISE** paragraph 3.A GENERAL TRADES specification section reference as follows:

    05 ~~**55**~~ **50** 00 – Metal Fabrications
  - **ADD** paragraph 3.A GENERAL TRADES specification section reference as follows:

    09 65 00 – Resilient Flooring
  - **REVISE** paragraph 3.A GENERAL TRADES specification section reference as follows:

    09 65 ~~**00**~~ **13** – Resilient Base and Accessories
  - **REVISE** paragraph 3.A.14.B to read as follows:

    3.A.14.B **Contractor shall protect the existing gymnasium floor and allow access to this area to other trades for their work. Contractor shall be responsible for gymnasium protection notes on A2.01 with the exception of maintaining moisture/humidity levels which will be provided by the 15A Contractor.**
  - **ADD** paragraph 3.A.37 with the following

    3.A.37 Contractor shall furnish and install all metal chase enclosures.
  - **REVISE** paragraph 3.B MECH/PLUMBING specification section reference as follows:

    05 ~~**55**~~ **50** 00 – Metal Fabrications
  - **ADD** paragraph 3.B.44 with the following

    3.B.44 Contractor shall be responsible to maintain moisture/humidity levels to prevent the gymnasium floor from warping.

- **REVISE** paragraph 3.C ELECTRICAL specification section reference as follows:

  05 ~~**55**~~ **50** 00 – Metal Fabrications

- ❑ 23 08 00 – HVAC Commissioning
  - **REPLACE** Section in its entirety with attached
- ❑ 23 09 23 – Direct Digital Building Systems Control
  - **REPLACE** HCPSS DDC/BAS Requirements at end of specification section with attached
- ❑ 23 24 19 – Positive Displacement Chiller
  - **ADD** *paragraph 1.60 with the following language*

1.60 BGE Chiller Rebate Requirements:

A. The project's air-cooled chiller qualifies for a $27,799 incentive from BGE through their Smart Energy Savers Program. The contractor shall not include any rebate incentive money within their bid for this equipment.

B. After award, the successful contractor shall fulfill all of BGE's requirements for participation within the rebate program, including making the application and performing the pre-demolition and post-construction inspections.

C. Upon final acceptance by BGE, the contractor shall receive the incentive check from BGE and provide HCPSS with a deduct change order in the amount of the total incentive obtained.

C. CHANGES TO DRAWINGS

1. ARCHITECTURAL DRAWINGS

- ❑ Sheet A0.05 – PHASING PLAN
  - **CHANGE** hatch in Area A to align with description listed in graphic Phasing Schedule. See full revised sheet, attached.

2. STRUCTURAL DRAWINGS

- ❑ None

3. MECHANICAL DRAWINGS

- ❑ None

4. PLUMBING DRAWINGS

- ❑ None

5. FIRE PROTECTION DRAWINGS

- ❑ None

6. ELECTRICAL DRAWINGS

- ❑ None

D. ATTACHMENTS

1. ADDENDUM DRAWINGS

- ❑ A0.05 – PHASING PLAN

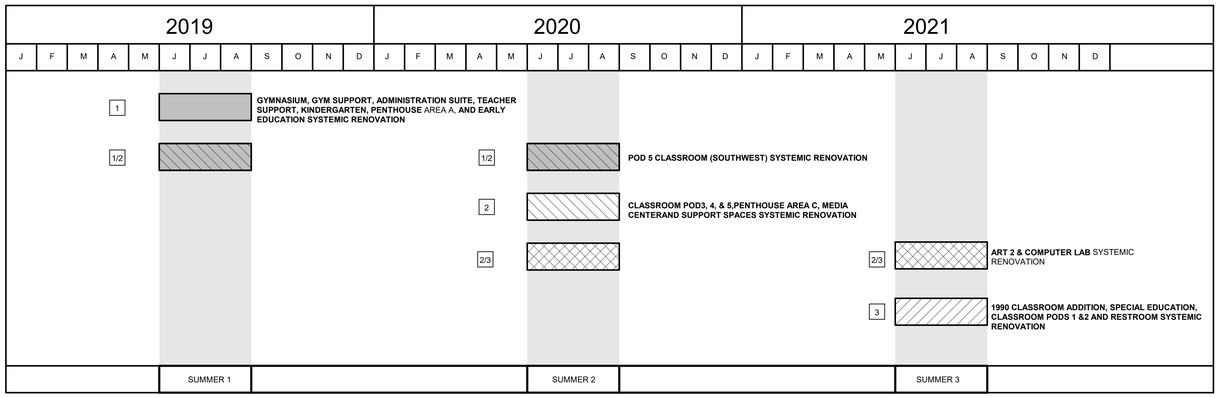
2. ADDENDUM SPECIFICATIONS

- ❑ 23 08 00 – HVAC Commissioning
- ❑ 23 09 23 – Direct Digital Building Systems Control *(HCPSS DDC/BAS Requirements only)*

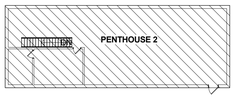
3. OTHER

- ❑ None

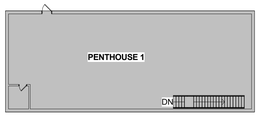
END OF ADDENDUM NO. 1



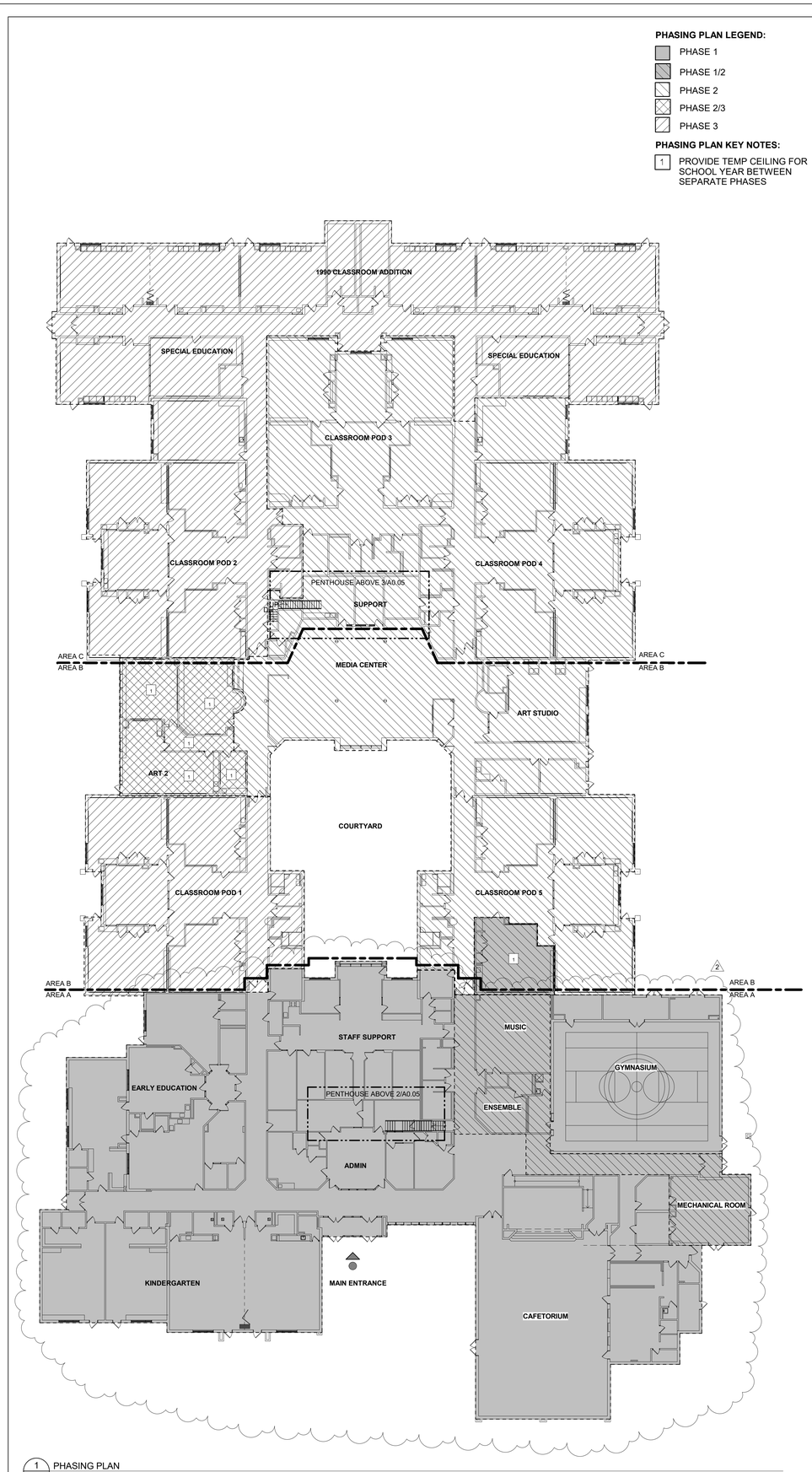
4 PHASING SCHEDULE
A0.05 SCALE: 1/8" = 1'-0"



3 PHASING PLAN - PENTHOUSE 2
A0.05 SCALE: 1" = 20'-0"



2 PHASING PLAN - PENTHOUSE 1
A0.05 SCALE: 1" = 20'-0"



1 PHASING PLAN
A0.05 SCALE: 1" = 20'-0"

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Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional architect under the laws of the State of Maryland, License No.: 9893, Expiration Date: 3/27/2020.

PROFESSIONAL SEAL:

PRINTS ISSUED

DATE:	DESCRIPTION:	NO:
10/10/2018	BID DOCS	6
12/17/2018	ADDENDUM 1	1
12/28/2018	ADDENDUM 2	2

POINTERS RUN ELEMENTARY SCHOOL SYSTEMIC RENOVATION

HOWARD COUNTY PUBLIC SCHOOL SYSTEM

SHEET TITLE:

PHASING PLAN

PROJECT NO: 17015.0000
DATE: 10/10/2018
SCALE: As indicated

WORKING NORTH

SHEET NO:

A0.05

12/26/2018 4:57:53 PM

23 0800
HVAC
COMMISSIONING

PART 1 - GENERAL

1.1 RELATED WORK

A. Division 01 – General Requirements

1.2 REFERENCES

A. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions and Division-1 Specification sections, apply to work of this section.

B. American Society of Heating and Air-Conditioning Engineers – ASHRAE (The HVAC Commissioning Process, ASHRAE Guideline). Latest version is applicable.

C. International Energy Conservation Code® (Commissioning Process - Section C408). Latest version is applicable.

D. ACG Commissioning Guideline - 2015

E. International Code Council (ICC) – Application of the Commissioning process.

1.3 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CxA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CxA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, owner, subcontractors, manufacturers and equipment suppliers.

B. The independent commissioning agent (CxA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 ROLES OF THE COMMISSIONING AGENCY

A. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of HVAC systems within the HCPSS Project.

B. The CxA shall function as a catalyst and initiator to disseminate information and assist the design and construction team in implementing completion of the construction process. This shall include system verification, functional performance testing (including trend/monitor based commissioning over a period of 7 days), and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

C. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

D. The CxA shall observe and coordinate testing as required to assure system performance meets the design intent.

E. The CxA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CxA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded. The CxA may use a website to keep permanent records and allow contractor data entry, in place of paper documentation that is not required from site Start-up sheets.

F. The CxA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process. Screenshots, Pictures and Videos may be used to prove correct or improper System operation per Sequence of Operation.

G. The CxA is to remain an independent party with specific knowledge of the project. The CxA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CxA shall monitor resolution for conformance with design intent and prevailing industry standards.

H. The CxA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test (including trend/monitor based commissioning over a period of 7 days); results shall be used in determining the start of the warranty period for HVAC systems and subsystems.

I. The CxA will review operating and maintenance materials for HVAC systems.

J. The CxA will review phasing plans as provided by the CM relating to temporary use of HVAC equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

3.2 SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

Roof Top Units (with & without DX)
Air Handing Units
Dedicated Outdoor Air Units
Fan Coil Units
Propeller Unit Heaters
Exhaust Fans
DDC Control System
VAV Terminal Units
Chiller & associated Pumps
Boiler & associated Pumps
Domestic Hot Water System
VRF System
Etc..

3.3 HVAC COMMISSIONING PLAN

A. Commissioning Team

1. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide

continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:

Project Manager (PM)
Office of School Construction (OSC)
Office of School Facilities (OSF)
Commissioning Team (CT)
Commissioning Agent (CxA)
Commissioning (Cx)
Design Team (A/E)
Construction Manager (CM)
Mechanical Contractor (MC)
Building Automation Controls Contractor (BAS)
Test and Balance Contractor (TAB)
Electrical Contractor (EC)

B. Basis of Design Document

1. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.
2. The CxA will review the BOD documents for adequate commissioning provisions, functional performance, and optimization of performance, accessibility, TAB provisions, and O&M considerations.

C. Commissioning Meetings

1. Commissioning meetings will be held in conjunction with the projects progress meetings as necessary. The CxA will be on site for the CX meetings. Commissioning meetings will be used to provide direction, address issues with work completed per project schedule, address deficiencies and to come up with resolutions to complete in a timely matter, address problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

D. Deficiency/Resolution Tracking Forms (DRTF)

1. The use of Deficiency/Resolution Tracking Forms is a method employed by the CxA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
2. The CxA will regularly submit DRTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of DRTF submission will be adjusted as project conditions dictate.

E. System Verification Checklists (SVC) / Manufacturers' Checklists

1. The MC will provide SVC's based on manufacturers start-up procedures. These tests should be provided for all systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS*. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed in the CM office on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
2. The CxA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CxA.
3. The CxA must also review the equipment manufacturers' checklists prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CxA before start-up can commence.

F. Start-Up

1. Start-up of major HVAC systems will be witnessed the CxA. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CxA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting HVAC equipment.
2. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. Factory-authorized Start-up Technicians & Control Technician's will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BOD.

G. Controls Monitoring

1. Close monitoring of the Control Contractor's progress will promote efficient coordination of the TAB work. The BAS will be expected to submit point-to-point checklists verifying that his work has been completed and all systems are ready for TAB work and Functional Performance Testing. The CxA for completeness and conformance with the BOD and the owner's scheduling requirements will survey Programming and Graphics install by the BAS.

2. The necessary steps to complete an HVAC Control System installation prior to CxA FPT's.
   a. Design Layout & Submittal of Controls, Diagrams, Details, Part numbers including Wiring Scheme & Sequences from the MEP Design Drawings.
   b. Design Layout & Submittal of Controls, Diagrams, Details, Part numbers including Wiring Scheme & Sequences from the MEP Design Drawings.
   c. Pulling wire and mounting controls is the first step to installation of Control Systems.
   d. Point-to-Point checkout & setup of all Controls, Transmitters, Transducers, Integration and so forth.
   e. Trends built along with all other HCPSS BAS_DDC Requirements. Use the latest version by the owner (OSC), then what is located in the specifications. Available upon request.
   f. Programming Installation & Initial Checkout of Control.
   g. Verification, Correction & Fine-Tuning, to make sure Programming is correct and meets Sequence of Operation and Specifications. (Self-Commissioning).
   h. Graphics and Verification. *This is the only item not absolutely required for commissioning to begin, as is only a window into the complete control system, and will be verified at the end of each Phase for turnover.

H. TAB Monitoring

1. The preliminary TAB report set-up will be reviewed prior to HVAC equipment start-up, in order to assure that the final TAB report format and content is acceptable.
2. TAB work will be monitored so that any problems that prevent or hinder proper air and water balance can be addressed and corrected with minimal delays. By addressing these problems as quickly as possible, we can assure that functional performance testing and owner training will take place on schedule.
3. TAB work will be completed per Phase, for proper System functionality between Phases of work. Example is for Water balance to assure proper GPM between Phases.
4. A pencil copy of the TAB report will be reviewed per Phase prior to submission of the final TAB report. A written review will be submitted per Phase to the TAB contractor and to the A/E for their comments. A TAB report approved by the A/E

will be required before Functional Performance Testing can be carried out per Phase. The CxA will visit the site during the TAB process in order to assist TABC and BAS in the effective completion of their scope of work.

I. Functional Performance Tests (FPT)

1. The CxA will write FPT's based on the respective sequence of operations. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS* above.
2. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CxA, owner (OSC) and the owner's maintenance staff (OSF). Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation, per G.2 of this section.
3. The Functional Performance Tests shall include HVAC and related equipment.

   a. AHU's will be tested in designed operating modes. Proper operation will be verified at minimum OA, maximum OA, automatic control, and other modes, if necessary, to achieve BOD conformance.
   b. Test Variable Air Volume terminals with reheats at minimum and maximum cfm set points, in the (Heat, Vent, Cool Modes), effective set points and under automatic control. Test secondary cfm settings based on sequence, based on greater load above the Cool set point and below the Heat set point, with temperature limits, etc...
   c. Test Fan Coil Units in designed operating modes.
   d. Test Propeller Unit Heaters in designed operating modes.
   e. Chilled water system will be tested in designed operating modes. Proper operation will be verified at minimum loads, maximum loads, waterside economizing mode, Manual control, automatic control, and other modes.
   f. Hot water system will be tested in designed operating modes. Proper operation will be verified at minimum loads, maximum loads, waterside economizing mode, Manual control, automatic control, and other modes.
   g. EF's will be tested for conformance to BOD. Check EC-Motor verses type of CS used and verify correct setup and compliant operation.
   h. Hydronic pumps will be tested under relevant operating conditions.
   i. Heat Exchangers will be tested under relevant operating conditions.
   j. DDC control systems will be tested as necessary.
   k. HVAC systems will be tested to assure that the building as an integrated system operates properly, labelled properly and that trends are built on usable points.
   l. Trend verification of systems and subsystems shall be completed prior to start of functional performance testing. CxA will confirm that the trend format meets the

HCPSS BAS_DDC Requirements and discuss trend requirements in CX meetings throughout the construction phase of project.

4. Deferred Testing

   a. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner (OSC). Deficiencies will be resolved and corrected by the appropriate contractor upon notice of deficiencies and testing rescheduled.
   b. Off-season mode testing will be implemented as necessary to assure conformance with the BOD. Installing contractors will be expected to participate as required by the project specifications.

5. Rescheduled Functional Performance Test

   a. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, their time will be billed to the contractor as an additional fee.
   b. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed for the commissioning personnel's return trip.

J. Building Turn-Over / Owner Orientation / User Training

1. The CxA will oversee contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
2. The CxA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.
3. Owner training will be coordinated with the assistance of the CxA. The training will be provided by the installing contractor 'or' manufacturer's representative as long as they are factory trained & vendor employed, and witnessed by the CxA. This training should include both classroom training and hands-on operational training while onsite, with OSC personnel involved with all Hands-On portions of training. All training will be videoed. The CxA will visit the site during the Turn-Over and Training period to assure that any on-going HVAC related problems are being addressed and corrected in a timely and efficient manner.
4. The CxA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

3.4 RESPONSIBILITIES OF TEAM MEMBERS

A. Construction Manager (CM)

1. Include commissioning requirements in the mechanical and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the HVAC commissioning process.
2. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
3. Assure that the CxA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
4. Coordinate inclusion of commissioning activities in the construction schedule.
5. Facilitate resolution of deficiencies identified by observation or performance testing.
6. Assist the CxA in monitoring the duct leakage testing.
7. Keep CxA and Contractors on pace with Construction Schedule.
8. Hold performance meeting when the MC or any of their subcontractors falls behind the construction Schedule.

B. Mechanical Contractor (MC)

1. Each contractor in this division shall include in their quote the cost of participating in the commissioning process.
2. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.
3. Assure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, water treatment, temperature controls, and TAB in commissioning activities.
4. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.
5. Attend commissioning meetings scheduled by the CxA and bring necessary subcontractors to each CxA meeting to include the BAS & TAB contractors when appropriate.
6. Assist the CxA in system verification and performance testing.
7. Prepare preliminary schedule for HVAC system inspections, O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period.
8. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of HVAC equipment.
9. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

10. Notify the CxA a minimum of two weeks in advance of scheduled system start-up.
11. Update drawings to as-built condition and review with the CxA throughout the construction process.
12. Verify that the BAS contractor is updating their corrected as-built ATC Drawings, as they make changes throughout the project for O&M submission.
13. Schedule vendor and subcontractor provided training sessions as required by project specifications.
14. Provide written notification that the following work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent.

    a. HVAC equipment including fans, air-handling units, direct outside air systems dehumidification units, ductwork, dampers, terminal devices, vrf, etc.
    b. Fire detection and smoke detection devices furnished under other divisions as they affect the operation of the HVAC systems, if included in work.
    c. That BAS is functioning in accordance with design intent.

15. Participate in the Functional Performance Tests.
16. Participate in the off-season mode testing.
17. Participate in O&M Training in project specifications.
18. Provide a complete set of as-built drawings and O & M manuals for review. The CxA shall review the as-built drawings and O&M manuals concurrently with the design team.

C. Test and Balance Contractor (TAB)

1. Include cost for commissioning requirements in the contract price.
2. Attend commissioning meetings scheduled by the CxA.
3. Submit the TAB procedures and preliminary TAB report to the CxA for review at least two weeks prior to beginning TAB work.
4. Notify the CxA a minimum of two weeks in advance of scheduled TAB work.
5. Provide partial, preliminary TAB Reports bi-weekly, Deficiency Reports weekly for remediation, when working on project. Then submit completed TAB report per phase, by building section, by system, or as required by the CxA.
6. Assist the CxA in system verification and performance testing.
7. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
8. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the CxA for verification or diagnostic purposes.
9. Participate in the Functional Performance Tests as required to achieve design intent.

10. Provide sound and vibration testing where required to assist in diagnosis of areas exhibiting unacceptable levels of noise or vibration.
11. Participate in the off-season mode testing as required to achieve design intent.
12. Participate in O&M Training per project specifications.

D. Building Automation Controls Contractor (BAS)

1. Include cost for commissioning requirements in the contract price.
2. Review control sequence and component selection for conformance with design intent.

    a. Attend a submittal review meeting with the CxA and Engineer to ensure clear understanding of scope of work and expectations.
    b. Verify that specified safeties and interlocks have been selected.
    c. Verify proper selection of control valves and actuators based on design parameters.
    d. Verify proper selection of control dampers and actuators based on design parameters.
    e. Verify that sensor selection conforms to design intent.

3. Attend all commissioning meetings scheduled by the CxA.
4. Provide the following submittals to the CxA:

    a. Hardware and software submittals.
    b. Control panel construction shop drawings.
    c. Narrative description of control sequences for each HVAC system and subsystem.
    d. Schematics showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access.
    e. A list of all control points, including analog inputs, analog outputs, digital inputs and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
    f. A complete listing of all software routines employed in operating the control system. Also provide a program narrative that describes the logic flow of the software and the functions of each routine and sub-routine. The narrative should also explain individual math or logic operations that are not clear from reading the software listing.
    g. Hardware operation and maintenance manuals.
    h. Application software and project applications code manuals.
    i. Load on "BAS provided laptop to HCPSS", the necessary Software to access the control system through the web browser. Provide CxA training on use of BAS web browser access for use when testing multiples of HVAC equipment without the need for the BAS contractor present.
    j. Panel and equipment insert documents.

k. Assist CxA with remote monitoring capabilities. Supply any software and/or hardware needed. (HCPSS VPN access achieved through request by OSC PM, then request is sent to IT, after the paperwork is filled out and returned to IT.

5. Verify that specified interfaces provided by others are compatible with BAS hardware and software.
6. Coordinate installation and programming of BAS with construction and commissioning schedules.
   a. Create all Change of Value (COV) trends for every control point. Create 10 minute timed trends when all Space Temperature COV trends are created. Make sure to review the latest HCPSS BAS_DDC Requirements document by OSC and suitable COV increments, so not to allow for an overload of comm traffic. If necessary, make adjustments to widen the COV increments to allow for the Stand-Alone Controllers/Web Server controllers to hold a couple days of Trend History when disconnected from the Mendenhall OSF Server.
7. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of HVAC equipment.
8. Provide control system program technician to assist during equipment startup and checkout. Corrections are welcome on the spot.
9. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
10. Participate in the Functional Performance Tests as required by the project specifications.
11. Provide control system program technician to assist during verification and performance testing when required by CxA. Corrections are welcome on the spot.
12. Provide system modifications to achieve proper system operation as defined by the "Sequence of Operation" per design intent by the engineer.
13. Provide support and coordination for TAB contractor. Provide all devices, such as portable operator terminals and all software for the TAB to use in completing TAB procedures.
14. Provide written notification that the BAS scope of work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent, and that BAS is functioning in accordance with design intent, as proven by the 7-day COV trend views.
15. Participate in the Functional Performance Tests as required to achieve design intent.
16. Participate in the off-season mode testing as required to achieve design intent.
17. Participate in O&M Training as required by project specifications. Include training on hardware operations, ATC as-built understanding & programming to achieve the final BAS/DDC System.

END OF SECTION

HCPSS BAS/DDC Requirements
Revision 12.21.18

General Notes:

Below is the Standard BAS/DDC Requirements by the HCPSS Office of School Construction.

Oversite will be by the A/E, CxA & Owner for Correct Setup, starting with the original building of the Points.
***If Points found to be in non-compliance with the BAS/DDC Requirements below, immediate correction must take place and all Company Technicians involved with our Projects will be informed and sent the most recent BAS/DDC Requirements, as this is a living document.**

A - As the BAS Requirements cannot cover all aspects of our Control System Vendors or their Control Systems capabilities and differences, it is up to the BAS Vendor to Submit an early plan of action as it pertains to these requirements through an RFI through the Proper Construction Process to obtain the correct direction in which to follow.
B - If the BAS/DDC Control Vendor fails to comply with the Specifications & the HCPSS BAS Requirements, contained herein, then it will be up to the discretion of the Owner/Engineer to request that the Vendor follow the BAS Vendor Specific, and latest HCPSS BAS/DDC Standards on record at No Cost to the Owner & with Owner/CxA/Engineer Oversight. Either the HCPSS OSC HVAC Project Management or the OSF Automation Controls Specialist will provide the Owner oversight.
C – It is paramount that all work performed is done intuitively, with the intention of keeping our HCPSS OSF School HVAC Technicians the ability to interpret & troubleshoot your installed systems upon Phased turnover. This includes the turnover of all O&M information needed to diagnose and maintain their equipment, per Phased turnover.
D – HCPSS typically requires All 3rd Party integration & the integration must be coordinated by the BAS/DDC Control Contractor, ME and the 3rd Party HVAC equipment supplier, prior to the beginning of any HVAC work. The BAS/DDC Contractor must obtain & understand the actual definitions for all of the required "in use" BACnet 3rd Party raw data points and the associated names that are being used on the project, along with the point's purpose & enumerations when there are multi-state points. Submit the 3rd Party Point List to Owner for review. Owner will choose Points to keep in the Tree view and those shown on the Graphics. If possible, add intuitive descriptors to the Points.
E – CxA to hold a "Controls Coordination Kickoff Meeting" before the Project begins, inviting the 3rd Party Vendors, the Control Contractor, the Mechanical Contractor, the Owner (HCPSS OSC HVAC Project Management or the OSF Automation Controls Specialist), the Mechanical Engineer of Record & any other Contractors deemed necessary. This will be an opportunity for all invited to discuss whether or not the Control & 3rd Party Vendor will 'or' will not meet the given "Sequence of Operation" by the Engineer of Record for the given Project & to come up with solutions.
F - HCPSS Construction fully utilizes the Control Contractor to control all Roof Top Units with exception to the DX Safety Circuits, Timers & Interlocked Condenser Fan operation, if used in place of Chilled Water Cooling. We would like the RTU manufacturer to preinstall all DX Components, with Stand-Alone Condenser Control, Safeties, and include a 0-10 VDC input for DX Compressor Staging, Heat/Cool/Dehum Mode Input(s), whether internal to Unit or external to Unit. Feedback points should be available for DX System Compressor Command, Status & Alarms. *All Unit DX Time Delays must be research, so not duplicated in ATC Control programs.
G - Requirements for all Contractors to meet to maintain Graphics uniformity. Create all individual Graphics with attention to the actual Unit layout and more importantly, the ability to quickly analyze & troubleshoot the Units operation status & the associated BAS Systems, by keeping Setpoint w/ variable controlled & Command w/ Status. We do not expect all Contractors to have Graphics that look alike, but the layouts should be typical & uniform. Please consider the position of all points as they relate in location to the Unit and Sequence of Operation. Use the latest School templates for the new layouts, as we are always looking to improve what we have. *Do NOT use Feedback points on Graphics, except for true feedback, such as from a VFD. If in doubt, RFI the A/E regarding any questions.
H – Graphic Points that should be located in a box in the upper open area; Multi-state points such as, Occupancy Schedule, Unit State, Unit Mode, Alarm Points not specifically related to point on below graphic (General Alarm), Fan Control Mode, Warm-Up & Cool-Down Modes, etc…

1. Show all Setpoints next too or on top/bottom of the Controlled Value.
    a) Examples;
        1. Effective DA Temp Setpoint w/ DA Temp
        2. Mixed Air Low Limit Setpt w/ MA Temp

3. Preheat Temp Setpt &/or Heat Enable w/ the Heat Coil & Preheat Temp
4. Zone Temp Setpt & Effective Zone Temperature Setpoint w/ the Zone Temp (shown below Unit).
5. Duct Static Setpt w/ the Duct Static (show split in ductwork to show that Duct Static Pressure read from a position 2/3rd's downstream).
6. Economizer Enable State & Economizer Setpoint with the Min OA cfm Setpoint &/or Damper Position w/ the Min OA Flow &/or Damper Position

2. Show all Commands next too or on top/bottom of the devices Status.
   a) Examples;
      1. Fan Command w/ Fan Status (if VFD used, also show Status Value of Analog Output Speed %)
      2. Pump Command w/ Pump Status (if VFD used, also show Status Value of Analog Output Speed %)
3. Show all Commands that determine a Mode by the associated area with Value & Setpoint.
   a) Examples;
      1. Economizer Lockout Setpt w/ the Economizer State (locate near the Outside Damper)
      2. Heat Enable Setpoint w/ the Heating Output Value (locate near the Heat Coil)
      3. Cool Enable Setpoint w/ the Cooling Output Value (locate near the Cool/DX Coil)
      4. Warmup Setpoint w/ the Return/Space Temp that it is referencing.

I – *EC-Motor insight based on experience at Hanover Hills ES (ES-42), where a normal current Switch would not work on several FCU Fans due to random current spikes from the EC-Motor. JCI added a Current Transmitter to FCU-4-12 and found that the EC-Motor would Spike up to 0.5 Amps. Due to this learned phenomena, we are switching from Current Sensing Switches to Low Current Transducers for EC-Motors for accurate Fan Status.

Alarm Setup:

A - *It is Critical that No Alarms transmit to OSF Sever or Phones until after the Project Phase has been Commissioned/Accepted, Training performed and proven to operate properly for Phased Turnover & that only the Critical Alarms Identified by the HVAC Project manager and OSF Team agree upon those points.
B - All Alarms shall be set to email or text to the Control Contractors & CxA to prove operability before the turnover of each Phase.

Alarm Priority Settings for Critical System Alarm Points to Page Emergency Personnel

C - Critical Systems include all Pumps/Heat/Cool/Geo Plant Equipment; RTU/AHU/RHPU/DOAS/DSS/H&V Units are included in this List.
D – For Unit Stand-Alone Control - Each Space shall contain a Non-BACnet, Wired Sensor directly connected to the Unit Controller, using it as a combination Unoccupied (Medium Priority) & Low Building Temperature Alarm (45.0 F, High Priority) Space Temperature Sensor, as listed below. Use the North most or highest "Outside Exposure Room" T'Sensor for Alarming and Night Setback Control. *Where FCU's & DOAS are used, the T'Sensor wired directly to the DOAS Units controller will provide the Alarms and Control of the Zone FCU Warmup/Cooldown and Night Setback. If this Sensor fails, then the Control Contractor should use the Control networks Daisy-Chained Controller - T'Sensor located in a worse case room for best control, as a Priority Control T'Sensor. *1st send the A/E an RFI for direction.
E – During Occupancy, exclude Entrance/Vestibule Heaters due to nuisance Alarms when doors open.
F – During the "Kitchen Hood" use time period, exclude the Fridge/Freezer Alarms, as doors are open during Lunch Service & will cause nuisance Alarms.
G – Alarms must have easily discernable Base Naming for NAE/Webs/Andover/etc. used for intuitive Alarm Paging.

Priority Ranges to route alarms to critical personnel, after Phase acceptance & turnover to OSF

***These Alarm Priority #'s may change with the personnel assigned for ON-Call.**

Rob Geelhaar	>=80 & <=99 (Any Day of the Week) *Must create two Alarms.
Sam Knight	>=80 & <=99 (Any Day of the Week) *Must create two Alarms.
??? Weekdays	=81 (Mon-Fri)
??? Weekdays	=83 (Mon-Fri)

??? Weekdays	=84	(Mon-Fri)
On Call West Side Weekdays	=91	(Mon-Fri after hours ONLY)
On Call East Side Weekdays	=92	(Mon-Fri after hours ONLY)
??? Weekend	=81	(Sat & Sun)
??? Weekend	=83	(Sat & Sun)
??? Weekend	=84	(Sat & Sun)
On Call West Side Weekend	=91	(Sat & Sun)
On Call East Side Weekend	=92	(Sat & Sun)

School Occupancy Hour Alarm Configurations –
G - Assign all School Alarms utilizing the third # in the School IP address.
Example: 171.21.**183**.71 for Thomas Viaduct Middle School would incorporate **183**, so the assigned HVAC Mechanic, receives ALL of the Alarms for that School.

Use these Critical Analog Alarm Points for Setpoint LIMITS: *(600 seconds as Alarm Delay.)

Unoccupied Space Heat Temp	50.0 deg F	Low limit
Unoccupied Space Cool Temp	90.0 deg F	Hi Limit
Chilled Water Temp	95.0 deg F	Hi Limit
Condenser Water Temp	105.0 deg F	Hi Limit
Hot Water Temp (Boiler)	200.0 deg F	Hi Limit
Hot Water Temp (Geo HP)	145.0 deg F	Hi Limit
Carbon Dioxide CO2 ppm	1650 ppm	Hi Limit
Chill Water Low Limit	35.0 deg F	Low Limit
Mixed Air Temperature	40.0 deg F	Low Limit
Supply Air Temp Low Limit	40.0 deg F	Low Limit

*Do not use deviation from Setpoint Alarms, as they cause too many nuisance Alarms.
** Make sure that Alarms are outside of any seasonal Normal Occupied/Unoccupied range.

Critical Binary Alarms & their associated Engineering Text: *(**Use 900 seconds Reference Delay-On Alarm**.)
Example: Reference = Pump Status, where the Alarm initiates only after 900 seconds of Command=On, Status=Off or Vice Versa.
*Alarm should not stay on for 900 seconds after it is no longer an Alarm. However, this may not be possible in some control systems.
**Use the Standard FAIL-ON for all Relays used for Heating, Cooling, Vent, Outside Lights, etc.
If in doubt, send RFI to A/E.

Chiller	Normal/Alarm	Normal/Alarm Fail OFF (General Alarm Dry Contact required)
Geo Water Pump	Normal/Alarm	Fail Pump ON *upon repair operation will restore automatically
Chill Water Pump	Normal/Alarm	Fail Pump OFF *upon repair operation will restore automatically
Condenser Pump	Normal/Alarm	Fail Pump OFF *upon repair operation will restore automatically
Boiler	Normal/Alarm	Normal/Alarm – Fail ON (Gen Alarm Dry Contact required)
Hot Water Pump	Normal/Alarm	Fail Pump ON *upon repair operation will restore automatically
Flame Safeguard switch	Normal/Alarm	Manual Reset Required.
DOAS Supply FAN	Normal/Alarm	Fail Unit Command ON for AUTO Reset once problem repaired.
AHU Supply FAN	Normal/Alarm	Fail Unit Command ON for AUTO Reset once problem repaired.
RTU Supply FAN	Normal/Alarm	Fail Unit Command ON for AUTO Reset once problem repaired.
DX Compressor Fail	Normal/Alarm	General Alarm Dry Contact by Unit Vendor.
General Unit Alarm	Normal/Alarm	General Alarm Dry Contact by Unit Vendor.

Freeze Stat Alarm	Normal/Alarm	Manual Reset Required.
High/Low Duct Pressure	Normal/Alarm	Manual Reset Required.
Smoke Detector	Normal/Alarm	Manual Reset Required by Electronics Shop.
EC-Motor (0-Low Amps)	Normal/Alarm	Fail Unit Command ON for AUTO Reset once problem repaired.
EC-Motor Fan Array (Alarm Contact)	Normal/Alarm	Fail Unit Command ON for AUTO Reset once problem repaired.

Required Trend/History Setup: Change of Value (COV)

A – Create COV Trend/Histories for all hard-wired points and most pseudo/program points during the Creation of the Points (not needed on shared points or setpoints, unless resetting type, w/ example of a SA/RA Temp Reset). *Use on Points as requested by Owner & CxA. *If problems occur and involve non-trended Points, then it will be the BAS Vendors responsibility to create the trends as needed.
B - The purpose of these trends is to prove operation over time, along with use for immediate evaluation & troubleshooting, to confirm correct operation prior to connection to the Server. *2-3 days needed without Server connected.
C – CxA acceptance of proper "Sequence of Operation" functionality will rely on 7-days of correct operation, as compared to all related points associated with the control. (Example: Space Temperature Control for a FCU with Heat/Cool Valves will look at the Space Temp, DA Temp, and Valve Positions as it controls both to the Heating and to the Cooling Setpoints).
D – Create timed trends along with COV trends on all Space Temperatures at a sample rate of 600 seconds. Create these along with the COV trends for HCPSS Management review.
E – Consider BACnet Traffic and any other Network Traffic for all Trending and best determine how COV Trend increments are setup, utilizing the COV Increments to slow down the rate of communication. Perform BACnet Loop Tuning for smoother 3rd Party Communication.
F – There must not be more than a 5-minute delay while live analysis of Trend Histories is taking place, unless the COV has not exceeded the COV increment setting.
G – Follow Communication Bus Protocol, including NO Splicing between Controllers, too many Controllers on a Bus, and too many Points on a Bus. If found to be the problem by the CxA/Owner/Engineer, the Control Vendor will be responsible to add Network Controllers, rewire Controllers on each Bus for a Balance of Communication, and correct problematic wiring that does not meet Communication Bus Protocols.

Trend Notes:

1. All critical points for troubleshooting and analysis must have **COV trends** created at the Local NAE/NCE/WEB's/Jace/Schneider etc... Controller.
2. Create Trends with Points during construction. *If unable to create trends, then provide to Owner substantiated reason for Points that cannot be trended.
3. The Trend setup conventions are in constant testing for the use of the least amount of RAM of the Local NAE/NCE/WEB's/Jace/Schneider etc... Controllers. The COV increment values should be adjustable to be raised/lowered to allow for the range of the 2-3 day desired period 'or' for a better analysis of Control, then returned once complete. This is necessary for times when the Tech's are unable to see the Front End server @ the Facilities Mendenhall Building or when Calibration is necessary at the Local Controller.
4. Send all Trends & store them in the Server/Repository, for records that go as far back as 1 year & 3 Months. This will allow for use as a comparison of operation to the previous Year or Season.

*Below are examples of sample rates to use, in order for Technician to see the longest timeframe possible through the controller, if the BAS Server is down or if connected locally.
If any issue occur with Com Buss, transfer speeds or RAM loss due to an overabundance of Trend Samples, then change the COV increment 1st before deleting or turning off Trended Points.
If all methods fail to bring proper functionality back to the BAS Com Buss, then consult the HCPSS OSC HVAC Project Management 'or' the OSF Automation Controls Specialist 1st, prior to any deletion of any Trended points.

If BACnet, then tune the BACnet Com Buss & any other busses as necessary for smooth operation.

Analog Outputs (0~10Vdc) that change values = 144 buffer size, with 0 seconds for interval and a Client COV increment setting of 0.5Vdc or 5.0%.
Most Analog inputs = 288 buffer size, with 0 seconds for interval and a Client COV increment setting of 0.2~5.0 F. OA CFM = a COV increment of 100 cfm. Determine based on percentage of Total flow and actual fluctuation.
Room Temp inputs = (two Trends each) 1st - 288 buffer size, with 0 seconds for interval and a Client COV increment setting of 0.3~0.5 F.
2nd - 288 buffer size (24 Hrs.), with 600 seconds for interval and a Client COV increment setting of 0.0 F.
Supply Air Temps = 288 buffer size, with 0 seconds for interval and a Client COV increment setting of 2.0 F.
Static Pressure = 288 buffer size, with 0 seconds for interval and a Client COV increment setting of 0.075"WC.
Building Static Pressure = 288 buffer size, with 0 seconds for interval and a Client COV increment setting of 0.005"WC.
All Binary Inputs = 44 buffer size, with 0 seconds for interval and a Client COV increment setting of 1.0 or blank.
All Binary Outputs = 44 buffer size, with 0 seconds for interval and a Client COV increment setting of 1.0 or blank.
Supply & Return Fan Command & Status = 44 buffer size, with 0 seconds for interval and a Client COV increment setting of 1.0 or 0.0.
All multi-State Enumeration points = 144 buffer size, with 0 seconds for interval and 0 seconds for interval and a Client COV increment setting of 1.0.

Engineering Units for Points.

a) All Temperature Sensors located in Spaces for Control shall be Calibrated to within 0.5 Deg F of the Certified reading. This rule supersedes that of any Specification that requires a higher value of accuracy (typically 1.0 Deg F), which can create a 2.0 Deg F difference between Rooms Temps next to each other. HCPSS Requires the use of the Fluke 51 Thermocouple Thermometer, w/ the K-Type Bead Probe for preferred accuracy, as this is the type of meter that our OSF Technicians use to calibrate temperature sensors when performing PM.

b) Records must be kept for all Temperature Sensor calibrations and turned over to CxA per RTU/DOAS grouping & phase. Note, that any Temperature Sensors found that have a 0.00 F Offset, should have a Offset of 0.01F to assure us that the sensor was calibrated.

c) In some cases, with Integration or updates, this will not be possible. *RFI A/E to make aware and to comment.

d) Do Not use a Decimal Point for Gpm, CFM, PSI, RH%, PPM, CO2, VFD, ECM Speed, Damper & Valve Position, etc...

e) Best Practice if the Point Value has the correct Engineering Unit Setup to begin with.

NOTE: The use of no decimal is preferred on most points, with Amps, Room Temps & other temperatures using 1 decimal, Duct Static pressure using 2 decimals & Bldg Static using 3 decimals. Send A/E RFI with any questions or comments.

	Eng Units	
Temperature	Deg F or F	****Use 1/10ths (70.0 deg F as example) on all Temperatures.**
Water Flow	Gpm	Gallons per minute
Air FlowCFM	CFM	Cubic Feet per Minute - Show Setpoint & Actual Airflow together on Graphic.
Water Pressure	Psi	Pressure per Square Inch - Show Setpoint & Actual Psi together on Graphic.
Static Pressure	inchWC	Inches of Water Column (1.50"W.C.) - decimal 100ths/Duct Press & 1,000ths/Bldg
Enthalpy	Btu/lb	British Thermal Units per pound - Show Stpt & Actual Enthalpy together on Graphic
Humidity	%RH or %	Show Setpoint and Actual Humidity on Graphic
CO2	PPM	Show Setpoint and Actual CO2 on Graphic
Valve	% Open (to coil)	**Use whole numbers
Damper	% Open or %Closed	**Use whole numbers

Inlet Vanes	% Open		**Use whole numbers
Position	% Open or %Closed		**Use whole numbers
VFD	%		**Use whole numbers
Frequency	Hz		**Use 1/10ths on this type of Point.
EC-Motor	Amps		**Use 1/10ths on this type of Point.
Voltage	Volts	Electrical Pressure	**Use 1/10ths on this type of Point.
Amperage	Amps	Electrical Current (Flow)	**Use 1/10ths on this type of Point.
Elect Power	KW	Kilowatts	**Use 1/10ths on this type of Point.
Energy - CHW	Tons	1 Ton = 12,000 Btu's	**Use whole numbers

Naming Conventions:

BAS/DDC Naming Requirements for all Systems with some exceptions

*The conventions below are required for intuitive and easy understanding of what each Point is.
**Any questions should be sent to the A/E through the RFI process.

NOTES for Point naming strings:

- **A-** Please prioritize this convention to any other Specification shown in a Mechanical Spec Section used on Projects that differ from this structure below. *If there is a problem on a Project site with Naming Conventions, create an RFI & have it refer to the A/E & HCPSS OSC HVAC Project Management or the OSF Automation Controls for a solution.
- **B-** All naming is to be used without any Spaces or any Wild Card characters, except for the underscore '_', Dash '-' or Capital to lower case (EffRmSetpt) to separate names in the naming line of a point. *This will allow seamless export to other formats and prevent the '%20' characters in an exported format.
- **C-** Only the Main Controllers for connection to Network Server and that handle the BACnet devices shall have the Full School Name.
- **D-** All Lower tier Controllers for AHU, FCU, etc..., shall have the Abbreviated version of the Site used in the Point name at the beginning of the string.
- **E-** After the School Abbreviation shall be the Com Buss, such as FC-1, FC-2, BACnet, etc.
- **F-** After the Com Buss Device shall be the HVAC System. Ex. AHU-1, FCU-1, VAV1-1, RTU-1, PUH-1, Chiller-1, Boiler-1, DOAS-1, etc.
- **G-** After the HVAC System shall be the Design Room #. Ex. A100, B27, C1, etc. *These Room #'s are now being located on each door top frame on the Outside for ease of cross-referencing in the occasion when the Principle decides to change them. *It will then be up to the HVAC Tech assigned to the School to keep an up to date cross-reference for Service calls, or the wrong rooms will receive attention.
- **H-** An example of a JCI Name String would be "hcpss-adx-jci:PVMS-NAE1/FC-1_RAHU-1_OADmprOut" for the Analog Output to the Damper (0~100% Open = 0-10Vdc) & "hcpss-adx-jci:PVMS-NAE1/FC-1_RAHU-1_OA_AirFlow" for the Analog Input (0-10Vdc) as Airflow Input in CFM.
- **I-** Request that Point naming strings are approved by HCPSS, as HCPSS holds the right to require Point naming per our conventions, as long as it is possible within the Vendors Controller &/or Front End communication device.

Notes for Naming Conventions for Control System, BAS & Graphics;

1 - Old 3 digit DDC abbreviations are NOT to be used in Point names, unless they are logical & easily understood by any HVAC Mechanic while performing their monitoring & troubleshooting duties using the new DDC/BAS/BACnet Points and Graphics.
2 - Only intuitive abbreviations are acceptable for the Naming abbreviations on the Control System BAS Point tree by our Control System Vendors.
3 - The Control Contractor shall then come up with a complete DDC Point list. This list will include all AI's, AO's, BI's, BO's, Setpoints, Pseudo Points, Multi-State Points, etc.

Here are some acceptable abbreviated examples:

Name	Abbreviation
Alarm	= Alm
Setpoint	= Setpt
Temperature	= Temp
Outside Air	= OA
Command	= Cmd
Status	= Sts
Condenser	= Cond
Building	= Bldg
Hot Water	= HW
Chilled Water	= CHW
Condenser Water	= CW
Face & Bypass	= F&B
Valve	= Vlv
Damper	= Dmpr
Effective Discharge Air Setpoint	= EffDaSetpt
Effective	= Eff
Enable	= En or Enbl
Discharge Air	= DA
Supply Air	= SA
Return Air	= RtAir
Relief Air	= RlAir
Exhaust Air	= ExAir
Economizer	= Econ
Low Limit	= LoLmt
High Limit	= HiLmt
Duct Static Pressure	= DuctStPress
Exhaust Fan	= EF
Humidity	= RH
Pressure	= Press
Cool Lockout Setpt	= ClgLkoutStpt
Heat Lockout Setpt	= HtgLkoutStpt
Variable Frequency Drive	= VFD

Minimum Acceptable

Point Name Abbreviations	Description *If Description area available, add Design Value to Descriptor. Acceptable description name
Alm	Alarm
Fc	Foot Candle *Do Not Use LUX, as is Metric measurement.
StPr	Static Pressure
Setpt	Setpoint *SP should not be used, as can refer to setpoint 'or' Static Pressure.
DSP	Duct Static Pressure
DSPStpt	Duct Static Pressure Setpoint
BSP	Building Static Pressure
BSPStpt	Building Static Pressure Setpoint
COMP	DX Compressor
CompOut	Digital Compressor Output
CompSts	DX Compressor Status
DS	Door Switch
DX	Direct Expansion
FZ	Freeze Stat (or Low Limit Safety)

LLT	Low Limit Temperature
MALL	Mixed Air Low Limit
HPL	High Pressure Limit
SD	Smoke Detector
SF	Supply Fan
RF	Return Fan
OA	Outside Air
RA	Return Air
MA	Mixed Air
HCD	Heating Coil Discharge
CCD	Cooling Coil Discharge
SA	Supply Air
SAT	Supply Air Temp
SAStpt	Supply Air Temp Setpoint
HTG	Heating
CLG	Cooling
BLR	Boiler
HWP	Hot Water Pump
HWS	Hot Water Supply
HWR	Hot Water Return
CH	Chiller
CHP	Chilled Water Pump
CWP	Condenser Water Pump
CHS	Chilled Water Supply
CHR	Chilled Water Return
CWS	Condenser Water Supply
CWR	Condenser Water Return
SF-C	Supply Fan Command
SF-S	Supply Fan Status
SA-T	Supply Air Temp
CLG-VLV	Cooling Valve Control
HTG-VLV	Heating Valve Control
MA-T	Mixed Air Temp
MA-LT	Mixed Air Low Temp
OA-DPR	Outside Air Damper or OA Damper
OAHtgLkOut	Outside Air Heating Lockout
OAClgLkOut	Outside Air Cooling Lockout
RA-T	Return Air Temp
RA-H	Return Air Humidity
SA-SP	Supply Air Static Press
SF-VFD	Supply Fan VFD
CH1-C	Chiller 1 Command
CH1-S	Chiller 1 Status
CHP1-C	Chilled Water Pump 1 Command
CHP1-S	Chilled Water Pump 1 Status
CWP3-C	Condenser Water Pump 3 Command
CWP3-S	Condenser Water Pump 3 Status
CHS-T	Chilled Water Supply Temp
CWS-T	Cond Water Supply Temp
SAT	Supply Air Temperature
RHVLV	Reheat Valve
SF1	Supply Fan 1
RF1	Return Fan 1
RV	Reversing Valve
CH1-CHST	Chiller 1 Chilled Water Supply Temp
CH1-CWST	Chiller 1 Condenser Water Supply Temp

HX1-HWST	Heat Exchanger-1 Hot Water Supply Temp
HX1-VLV	Heat Exchanger -1 Steam Valve
TON-STRT	Tons to Start Lag CH
STRT-DLY	Delay before Lag Start (or Start Delay)
STRT-TMR	Lag Start Timer (or Start Timer)
VFD	Variable Frequency Drive