Howard County Public School System

Office of Purchasing
10910 Clarksville Pike
Ellicott City, Maryland 21042-6198
(410) 313-6723, fax (410) 313-6789

PROJECT MANUAL

CONTROLS UPGRADE
BONNIE BRANCH MIDDLE SCHOOL
BID #100.23.B3

ISSUE DATE:	**Monday, April 24, 2023**
SEALED BID FOR:	**Controls Upgrade – Bonnie Branch Middle School**
BID NUMBER:	**Bid #100.23.B3**
PRE-BID DATE:	**Friday, April 28, 2023 at 10:00 AM**
PRE-BID ACCESS:	**Join on your computer or mobile app** Click here to join the meeting **Or call in (audio only)** **+1 301-960-8312,,380346235#** United States, Silver Spring Phone Conference ID: 380 346 235#
SITE VISIT:	**Friday, April 28, 2023 at 1:00 PM**
LAST DATE & TIME FOR QUESTIONS:	**Thursday, May 4, 2023 at 1:00 PM in writing** Submit To: Kristal Burgess at Kristal_Burgess@hcpss.org
RESPOND DATE:	**Monday, May 15, 2023**
RESPOND TIME:	**1:00 P.M.** to BidsandProposals@hcpss.org.
PURCHASING SPECIALIST:	Ms. Kristal Burgess phone: 410-313-6723 fax: 410-313-6789 email: Kristal_Burgess@hcpss.org

Engineer/Architect:
Building Dynamics, LLC
8600 Foundry Street, Suite 306
Mill Box 2054
Savage, MD 20763

Howard County Public School System

Office of Purchasing
10910 Clarksville Pike
Ellicott City, Maryland 21042-6198
(410) 313-6723, fax (410) 313-6789

SECTION 00200

NOTICE TO BIDDERS – INVITATION TO BID #100.23.B3

CONTROLS UPGRAGE
BONNIE BRANCH MIDDLE SCHOOL

The Howard County Public School System requests your quote to: Provide an automatic temperatures controls upgrade consisting of the replacement of the existing pneumatic controls for the airside HVAC systems with direct digital controls (DDC) as described in the contract documents (drawings and specifications) prepared by Building Dynamics, LLC dated March 31, 2023. This project is Federally funded and will require bidders to utilize Davis-Bacon Act prevailing wage to determine the total cost of the project in addition to (MBE) Minority Business Enterprise compliance and other associated state requirements.

Bid documents may be obtained on **Monday, April 24, 2023** at the Howard County Department of Education, Purchasing Office website https://purchasing.hcpss.org/business-opportunities. It is the responsibility of the bidder to print documents/drawings to scale.

PRE-BID MEETING:
A Pre-bid teleconference to be attended by all bidders will be held on Friday, April 28, 2023 at 10:00 AM. Directions to join conference are as follows; **Join on your computer or mobile app** Click here to join the meeting **Or call in (audio only) +1 301-960-8312,, 380346235#** United States, Silver Spring Phone Conference ID: 380 346 235# Howard County Public School System staff will explain the scope of work and answer any questions about the bidding specifications that will assist in the preparation of bids. Attendance is not mandatory, however, it is highly recommended.

SITE VISIT:
A site visit will be offered at Bonnie Branch Middle School, 4979 Ilchester Rd, Ellicott City, MD 21043 on Friday, April 28, 2023 at 1:00 PM. The Engineer and HCPSS Project Manager will explain the scope of the project and answer questions about the bidding documents that will assist in the preparations of bids. Attendance is not mandatory but strongly recommended and will assist the Owner in evaluating bids to determine if the bid can be considered responsive and/or responsible. **All interested bidders should meet outside the front entrance of the school prior to 1:00 PM and then will be escorted by school staff to the site.**

QUESTIONS:
All questions shall be directed, in writing, no later than 1:00 PM, Thursday, May 4, 2023 to Kristal Burgess, Procurement Specialist, Kristal_Burgess@hcpss.org. The Howard County Public School System is under no obligation to respond to any questions that are received after the cutoff date and time. Only answers provided via addenda issued by the HCPSS will be binding. Under no circumstances are bidders, including third party vendors or their staff, to contact any other HCPSS Staff, employees or any related constituency for purposes associated with this solicitation, including but not limited to, obtaining or providing information. Bidders failing to comply with this requirement may be disqualified.

BIDS SUBMISSION:
Bids MUST be submitted electronically via email in their entirety (all pages) in PDF format no later than Monday, May 15, 2023 at 1:00 P.M. to BidsandProposals@hcpss.org. Proposals that contain either more than one file, or files larger than 75MB, shall be inserted into an e-folder and compressed in a zip file. To ensure delivery, if file size cumulatively exceed 75MB, it is recommended that bidders submit separate emails labeled No.1, No.2, etc. Do not copy the Procurement Specialist with your proposals. Proposals must only be sent to the Bids and Proposals e-mail address.

Email subject lines, Folder names and File names shall include: The "Bid Title, Bid Number, 096.23.B3 and Company Name"."Bid Number, 100.23.B3 and Company Name". In the body of the email please include Bidder's contact person's email and cell phone number for contacting purposes if/when necessary.

BID OPENING:
Bid opening will not be open to the public. Sealed bids will be opened electronically by the Purchasing Officer after the due date and time. The Purchasing Officer shall provide the bid results via a bid tab to be posted on the school system website within a reasonable time after the bid opening for all bidders to review.

ADDENDA:
It is the potential bidder's sole responsibility to regularly visit the HCPSS Purchasing website https://purchasing.hcpss.org/business-opportunities to download and acknowledge receipt of all Addenda. It is highly recommended that bidders ascertain if they have received all the addenda issued prior to submitting their proposal. Failure of any bidder to acknowledge any such Addenda or interpretation may not relieve such bidder from obligation under his/her proposal as submitted.

The Howard County Public School System reserves the right to waive any informalities in, or to reject any or all bids.

Certified Minority Business Enterprises are encouraged to respond to this solicitation notice.

There are no Minority Business Enterprises requirements.

Contractors are required to register on eMaryland Marketplace Advantage at eMaryland Marketplace Advantage (eMMA) within five days following notice of award. Maryland law requires local and state agencies to post award notices on eMaryland Marketplace Advantage This cannot be done without the contractor's self-registration in the system. Registration is free. Failure to comply with this requirement may be considered grounds for default. It is recommended that any interested bidder register with eMaryland Marketplace Advantage regardless of the award outcome for this procurement as it is a valuable resource for bid notification for municipalities throughout Maryland.

Kristal Burgess
Procurement Specialist

Howard County Public School System

Office of Purchasing
10910 Clarksville Pike
Ellicott City, Maryland 21042-6198
(410) 313-6723, fax (410) 313-6789

NO BID REPLY FORM

Sealed Bid for: **Controls Upgrade – Bonnie Branch MS**

Bid Number: **Bid #100.23.B3**

Bidder: _____

To assist us in obtaining good competition on our request for bids, we ask that each firm that has received an invitation, but does not wish to bid, state their reason(s) below.

Unfortunately, we must offer a "No Bid" at this time because:

_____ 1. We do not wish to bid under the terms and conditions of the Bid document. Our objections are:

_____

_____

_____ 2. We do not feel we can be competitive.

_____ 3. We cannot submit a bid because of the marketing or franchising policies of the manufacturing company.

_____ 4. We do not wish to sell to The Howard County Public School System. Our objections are:

_____

_____ 5. We do not sell the item(s)/service(s) requested in the specific specifications.

_____ 6. Other: _____

_____

TABLE OF CONTENTS

CONTROLS UPGRAGE
BONNIE BRANCH MIDDLE SCHOOL
BID #100.23.B3

END OF SECTION

AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

THE OWNER:
(Name, legal status, address, and other information)

THE ARCHITECT:
(Name, legal status, address, and other information)

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201-2007 Edition and as modified by Howard county Public School System or other Contract Documents as applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein.

(Paragraphs deleted)

The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

(Paragraph deleted)

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Construction Manager and Architect at least seven business days prior to the date for receipt of Bids.

(Paragraphs deleted)

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

(Paragraph deleted)

§3.3.1.Bids shall be based upon the materials, systems and equipment required by the bidding documents without exception. Proposed substitute products or manufacturers shall be submitted in accordance with the following provisions:

a. No substitutions will be considered prior to receipt of bids. The Contract award will be made solely on the basis of Base bid, Alternate Bids with regard to proposed substitutions and deducts when requested.

b. Bidders may propose substitutions for the materials, systems and equipment specified or whom by listing them in the space provided on the Form of Proposal, along with any stipulated cost adjustment (add. deduct or no change) in the Base Bid or Alternate bids. Proposed substitutions may be accepted with the award of the contract or later by the Owner.

c. Provide all necessary backup data for proposed substitutions at time of bid for review by Owner.

d. The Architect will evaluate all substitutions based on compliance with the environmental goals stated in the specifications. All proposed substitutions shall document and demonstrate meeting or exceeding LEED certification requirements through product data, MSDS sheets and other supporting literature that highlight conformance. Any substitution that does not have this information highlighted will be rejected.

§ 3.3.2 It is the responsibility of the bidder to provide documentation with the bid at the date and time set forth for submission. The burden of proof that proposed substitutes are in fact equal or better falls on the bidder and proof must be to the satisfaction of HCPSS. The HCPSS shall be the sole authority as to whether proposed substitute items meet specifications or are an approved equal. The HCPSS decision of approving or disapproving of a proposed equal shall be final.

(Paragraphs deleted)

§ 3.3.3 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

(Paragraphs deleted)
§ 3.4 ADDENDA
§ 3.4.1 Addenda will be
(Paragraphs deleted)
posted on the school system website.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than two days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES
§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents. Submit Form of Proposal (Bids) in triplicate.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium. If blanks do not apply insert " O " in spaces.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.5 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

(Paragraphs deleted)
§4.1.6 All addenda shall be acknowledged on the Form of Proposal

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

4.2.2 Bonds shall be written by a bonding company that must be licensed with Maryland Insurance Administration to do business in the state of Maryland and otherwise acceptable to the Howard County Public School System. The Contractor shall use Bond Form provided by the Owner AIA 310 Bid Bond, in order to satisfy the Bond requirements referenced in this Article and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney in an amount not less than required.

4.2.3 The bonding company furnishing the Bid Bond shall provide upon request to the Purchasing Department, the following statement, signed by an authorized representative for the bonding company: **As surety for (Name of**

Contractor), (Name of Bonding Company), hereby agrees to furnish the 100% Performance, Labor and Materials Bonds, as required by the specifications for the (Name of Project), on behalf of the Contractor, in the event that such firm be the successful bidder for this project. Failure to provide this statement may be cause to reject submitted bid.

§ **4.2.4** Bid Bond shall be in the amount of 5% of the Base Bid.

(Paragraph deleted)
§ **4.2.5** The apparent low bidder, upon notification, shall provide to the Owner/ Purchasing Office within 24 hours three (3) references of successfully completed projects from General Contractors and/or Construction Managers and/or Owners. Failure to provide these references will be cause to reject the submitted bid.

(Paragraphs deleted)
§ **4.2.6** The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either

(a) the Contract has been executed and bonds, if required, have been furnished, or
(b) the specified time has elapsed so that Bids may be withdrawn or
(c) all Bids have been rejected.

§ **4.2.7** To protect the public interest the Owner may request a D & B (Dun & Bradstreet ®) report on the apparent low bidder. D & B rating less than A shall be cause for rejection of bid by Owner.

§ **4.2.8** Owner reserves the right to request from apparent low bidder financial statements for the firm for up to 3 fiscal years..

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1
(Paragraphs deleted)
All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ **4.3.2** Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ **4.3.3** The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ **4.3.4** Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

(Paragraph deleted)
§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ **4.4.1** A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ **4.4.2** Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date and time stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ **4.4.3** Withdrawn Bids may be resubmitted up to the date and time designated for

(Paragraphs deleted)
the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid, Alternate Bids, and proposed Substitutions which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

(Paragraphs deleted)

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

.1
(Paragraphs deleted)
names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

(Paragraphs deleted)
§ 6.33 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

(Paragraph deleted)

§7.1 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1.1 The Contractor shall furnish a Performance Bond and Labor and Materials Payment Bond covering the faithful performance of the Contract and the payment of all obligations arising thereunder and complying with the requirements of

Maryland Law. Both bonds shall be in the amount of one hundred percent (100%) of the Contract amount and shall name the Howard County Board of Education as Obligee.

§ 7.1.2 Bonds shall be written by a bonding company that must be licensed with MD Insurance Administration to do business in the State of Maryland and otherwise acceptable to the Howard County Public School System. The Contractor shall use Bond Forms provided by the Owner AIA Document A312 - 2010 Performance Bond and AIA Document A312 – 2010 Labor and Material Payment Bond, in order to satisfy the Bond requirements referenced in this Article.

§ 7.1.3 Owner reserves the right to request from Contractor financial statements for the firm for up to prior 3 fiscal years.

§ 7.1.4 To protect the public interest the Owner may request a D & B report on the Contractor. Should the D & B rating fall below the awarded rating, Contractor shall advise Owner of his corrective measures.

§ 7.1.5 Firms issuing said bonds must be licensed to write bonds in the State of Maryland. The Contractor shall pay the premiums for required bonds. Obtainage of the required bonds by Contractor shall be a condition precedent to effectuation of the Contract between Owner and Contractor. If additional work is authorized, the amounts of the bonds shall be increased to cover the value of the increased Contract sum. All bonds shall conform to the requirements of the Maryland Little Miller Act. All bonds shall be subject to Owner's approval.

(Paragraphs deleted)
§ 7.1.6 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

§ 7.1.7 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner with the executed contract and dated with the date of contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312-2010, Performance Bond and Labor and Material Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

(Paragraph deleted)
§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney effective as of the date of execution of the contract..

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101-2007 edition as modified by Howard County Public School System, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

(Table deleted)(Paragraphs deleted)(Paragraphs deleted)

SECTION 003000
FORM OF PROPOSAL

CONTROLS UPGRADE
Bonnie Branch MS
BID #100.23.B3

Date:_____ Owner: Board of Education
of Howard County Maryland
10910 Clarksville Pike
Ellicott City, MD 21042
Tel (410) 313-6723

Contractor:_____
_____
_____
_____

Engineer/Architect: Building Dynamics, LLC
8600 Foundry Street, Suite 306
Mill Box 2054
Savage, MD 20763

The undersigned, having carefully examined the Bid Announcement and Bid Documents proposes to furnish all specified materials and specified equipment in strict accordance with the aforesaid documents for the Lump Sums as follows:

BASE BID

1. Complete installed cost for the Controls Upgrade at Bonnie Branch MS and all appurtenances, as indicated on the drawings, specifications and addenda.

TOTAL PROJECT COST – Controls Upgrade

Bonnie Branch Middle School $ _____

Please indicate below your Total Base Bid amount in words:

_____ and ---- /100 Dollars.

NOTE: Bid Form shall reflect bids for the project as shown in the Contract Specifications and addenda. Substitutions shall be included in the section "Proposed Substitutions."

* Note: References to Architect will also include Engineer in all bid documents.

EQUIPMENT AND MANUFACTURERS

All bidders on the project are hereby required to name at time of bid the manufacturer name to be provided as part of their bid in accordance with the contract documents.

Controls Upgrade Manufacturer:_____

PROPOSED SUBSTITUTIONS

Proposed substitutions shall be submitted in accordance with Instructions to Bidders, see Section 00100 Instructions to Bidders, Article 3, Bidding Documents, 3.3 Substitutions. Bids will be considered on systems, processes, or products of manufacturers other than those cited if accompanied by detailed technical specifications for each item, catalogs, test reports, brochures, and other descriptive literature and supporting data, sufficient in detail to permit evaluation of the proposed substitution without further reference.

Proposed Substitutions	Price Change
_____	$_____
_____	$_____
_____	$_____

SUBCONTRACTORS: Bidders are hereby required to name the subcontractors as part of their bid package.

Name of Company	Type of Work
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

REFERENCES

Bidders are hereby required to list three references for whom similar work has previously been performed within the last three years:

Name: _____

Address of Site: _____

Nature of Job: _____

Person to contact: _____

Telephone: _____

Name: _____

Address of Site: _____

Nature of Job: _____

Person to contact: _____

Telephone: _____

Name: _____

Address of Site:_____

Nature of Job: _____

Person to contact: _____

Telephone: _____

COMPANY INFORMATION

_____ _____
Name of company years in business

_____
Street Address

_____
City State Zip

_____ _____
Telephone # Fax #

CONTRACT ADMINISTRATOR

Name_____ Title_____

Address_____ Phone_____

_____

Cell phone_____ e-mail_____

ADDENDA

Receipt of the following addenda is acknowledged:

Addendum No._____Dated_____ Addendum No._____Dated_____

Addendum No._____Dated_____ Addendum No._____Dated_____

Addendum No._____Dated_____ Addendum No._____Dated_____

WARRANTY TO THE LUMP SUM

The undersigned affirms that the above base bid and alternates represents the entire cost of the project in accordance with the bid documents and that no claim will be made on account of any increase in wage, scales, material prices, taxes, fasts, cost indexes or any other rate affecting the construction industry and/or this project.

If the undersigned received written notice of the acceptance, at his designated address, within sixty (60) days after bid opening (or later if bid has not been withdrawn), the undersigned agrees to execute and deliver a contract and bonds in accordance with the bid as accepted, within seven (7) days after receiving notice, or forfeit the amount of the bid bond.

AFFIDAVIT

Special Instructions: An authorized representative of the bidder shall complete the following affidavit in accordance with these bid documents and insert answer to paragraphs 1 and 3.

Statutory Affidavit and Non-Collusion Certification

I, _____, being duly sworn, depose and state:

1. **I am the _____ (officer) and duly authorized**

Representative of the firm named _____ whose address

is _____ and that I possess the authority to make this

affidavit and certification on behalf of myself and the firm for which I am acting.

2. Except as described in Paragraph 3 below, neither I, nor to the best of my knowledge, the above firm, nor any of its officers, directors, or partners, employees, agents, or employees of agents who are directly involved in obtaining or performing contracts with any public bodies has:

    (a.) Been convicted of bribery, attempted bribery, or conspiracy to bribe, under the laws of any state of the federal government;
    (b.) Been convicted under the laws of the state, another state, or the United States of: a criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or fraud, embezzlement, theft, forgery, falsification or destruction of records, or receiving stolen property;
    (c.) Been convicted of a criminal violation of an antitrust statute of the State of Maryland, another state, or the United States;

(d.) Been convicted of a violation of the Racketeer Influenced and Corrupt Organization Act, or the Mail Fraud Act, for acts in connection with the submission of bids or proposals for a public or private contract;
(e.) Been convicted of any felony offenses connected with obtaining, holding, or maintaining a minority business enterprise certification, as prohibited by Section 14-308 of the State Finance and Procurement Article;
(f.) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction under any of the laws or statutes described in Paragraph (a) through (e) above; or
(g.) Been found civilly liable under an antitrust statute of this State, another state, or the United States for acts or omissions in connection with the submission of bids or proposals for a public or private contract.

3. **The only conviction, plea, or admission by any officer, director, partner, or employee of this firm to involvement in any of the conduct described in Paragraph 2 above is as follows:**

If* none, write "None" below. If involvement, list the date, count, or charge, official or *administrative body, the individuals, their position with the firm and the sentence or disposition of ***the charge.***

_____

_____

(you may attach an explanation as necessary)

4. I affirm that this firm will not knowingly enter into a contract with a public body under which a person or business debarred or suspended under Maryland State Finance and Procurement Title 16, subtitle 3, Annotated Code of Maryland, as amended, will provide, directly or indirectly, supplies, services, architectural services, construction-related services, leases of real property, or construction.

5. I affirm that this proposal or bid to the Board of Education of Howard County Maryland is genuine and not collusive or a sham; that said bidder has not colluded, conspired, connived and agreed, directly or indirectly, with any bidder or person to put in a sham bid or to refrain from bidding and is not in any manner, directly or indirectly, sought by agreement of collusion or communication or conference, with any person to fix the bid prices of the affidavit or any other bidder, or to fix any overhead, profit or cost element of said bid price, or that if any bidder, or to secure an advantage against the Board of Education of Howard County Maryland or any other person interested in the proposed contract; and that all statements in the proposal or bid are true. I acknowledge that, if the representations set forth in this affidavit are not true and correct, the Board of Education of Howard County Maryland may terminate any contract awarded and take any other appropriate action.

6. I affirm that this firm will not knowingly employ an individual to work at a school if the individual is a Registered Sexual Offender, pursuant to section 11-722 (C) of the Criminal Procedure Article of the Annotate Code of Maryland. A firm or person who violates this section is guilty of a misdemeanor and on conviction is subject to imprisonment not exceeding 5 years or a fine not exceeding $5,000 or both.

The statements contained in this affidavit shall be incorporated into the awarded contract as material provisions and shall be effective throughout the life of the contract. The firm has a continuing obligation through the life of the contract to submit a revised affidavit should the firm discover information, or events occur, which render the contents of this affidavit erroneous or incomplete or which would result in the firm providing a different response. The firm's failure to submit a revised affidavit within three (3) working days of either its awareness of any error, change of circumstances, incompleteness, etc., or request by the owner shall constitute breach of contract.

Upon submission of a revised affidavit, the owner has the right to take such actions as may be necessary, in the judgment of the owner, to maintain and enforce the provisions of the affidavit, including termination of the contract.

I DO SOLEMINLY DECLARE AND AFFIRM under the penalties of penalties that the contents of these affidavits (Statutory and Non-Collusion) are true and correct, that I am executing this Affidavit in compliance with Section 16-311 of the State Finance and Procurement Article, Annotated Code of Maryland, and the Non-Collusion Certification in compliance with requirements of the Board of Education of Howard County Maryland, and that I am executing and submitting this Form of Proposal on behalf of and with full authority by the bidder named below.

_____ _____
(Signature of Bidder) (Date)

_____ _____
(Print Name of Bidder) (Title of Bidder)

SUBSCRIBED AND SWORN to before me on this _____ day of _____, 2022.

NOTARY PUBLIC

Name_____ Seal:

My Commission Expires_____

_____
(Legal Name of Company)

_____
(Address)

_____
(City) (State) (Zip)

_____
(Telephone) (Fax)

_____
(E-mail address)

Contractor's License Number # _____

We are/I am licensed to do business in the State of Maryland as a:
( ) Corporation ( ) Partnership ( ) Individual ( ) Other

eMaryland Marketplace Advantage (eMMA)#: _____

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year 2021
(In words, indicate day, month and year)

BETWEEN the Owner:
(Name, address and other information)

and the Contractor:
(Name, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, address and other information)

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications

Init.
/

issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

Contract Package:

Alternate No.:

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall
(Paragraphs deleted)
be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Paragraphs deleted)

§ 3.2 The Contract Time shall be measured from the date of commencement,
that shown on the Progress Schedule.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than .....
The respective dates applicable to this Contract as indicated on the Progress Schedule. The fully developed Progress Schedule issued by Architect/Owner, and hereby fully incorporated into this Agreement, contains

Portion of Work
100 % Complete

, subject to adjustments of this Contract Time as provided in the Contract Documents.
. Liquidated Damages in the sum of one thousand ($1000.00) for each calendar day shall be assessed for any delays in achieving Substantial Completion, except as noted in Article 8 of the General Conditions of the Contract for Construction. "Substantial Completion" as defined in Article 9.8 of the General Conditions of the Contract for Construction. In addition to Liquidated Damages for delay, as provided above, the Owner shall be entitled to such other damages for breach of contract as more fully provided in the General Conditions for Contract for Construction.

(Paragraph deleted)
(Table deleted)
(Paragraphs deleted)

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract including Alternates and Substitutions the Contract Sum shall be:
$... ..... ($),
subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
Alternate Numbers:

N/A

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

(Table deleted)
(Paragraphs deleted)
(Table deleted)
(Paragraph deleted)
§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item
As listed in the Form of Proposal;

(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)
ARTICLE 5 PAYMENTS
§ 5.1 PROGRESS PAYMENTS
§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

Contractor shall submit to the Architect on the last day of each month a draft of a Standard Monthly Contractors Requisition for Payment, on AIA Document G702 – 1992 and AIA Document G703 – 1992

(Paragraphs deleted)
§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of ten percent (10 %)

.2 Portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of ten percent (10 %);

(Paragraphs deleted)
§ 5.1.7 Deleted

(Paragraphs deleted)
§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
As described in the General Conditions for the Contract of Construction.

§ 5.1.9 Deleted

§ 5.2 FINAL PAYMENT

§ 5.2.1 1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor in accordance with Paragraph 9.10 of the General Conditions for Contract.

§ 5.2.2 Deleted

(Paragraphs deleted)

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1

(Paragraphs deleted)

As specified in Contract Documents

(Paragraphs deleted)

§ 6.2 Deleted

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201-2007 and modifications made by Howard County Public School System.

(Paragraphs deleted)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201-2007 and modifications made by Howard County Public School System.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201-2007 and modifications made by Howard County Public School System or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

(Paragraphs deleted)

§ 8.4 The Contractor's representative:

(Name, address and other information)

§ 8.5 The Contractor's representative shall not be changed without ten days' written notice to the Owner

(Paragraphs deleted)

§ 8.6 Delete:

(Paragraphs deleted)

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is the executed Standard Form of Agreement Between Owner and Contractor, AIA Document A101-1997 and modifications made by Howard County Public School System.

§ 9.1.2 The General Conditions are the 2007 edition of the General Conditions of the Contract for Construction, AIA Document A201-2007and modifications made by Howard County Public School System.

§ 9.1.3 Delete

§ 9.1.4 The Specifications:

(Paragraph deleted)

The Specifications are those contained in the Project Manual, and are as follows:
Title of Specifications exhibit: As listed in Table of Contents of Project Manuel dated:

§ 9.1.5 The Drawings:

The Drawings are as follows, and are dated unless a different date is shown below:

(Table deleted)

Title of Drawings exhibit: As listed in the Schedule of Drawings of the Contract Title of Drawings exhibit:

(Table deleted)

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

(Paragraph deleted)

As listed in the Project Manual.

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

Type of insurance or bond
As listed in the Project Manual

(Paragraphs deleted)

This Agreement is entered into as of the day and year first written above and is executed in at least four original copies of which one is to be delivered to the Contractor, one each to the Construction Manager and Architect for use in the administration of the Contract, and the remainder to the Owner.

OWNER	**CONTRACTOR**
Board of Education of Howard County	
(A Body Politic and Corporate)	
(Signature)	*(Signature)*
Chao Wu, Chair (SEAL)	(SEAL)
	(Printed name and title)

Approved by:

Michael J. Martirano, Ed. D., Superintendent of Schools

Init.

/

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

(Row deleted)
As Principal, hereinafter called the Principal, and
a corporation duly organized under the laws of the State of as Surety, hereinafter called the Surety, are held and firmly bound unto

As Obligee, hereinafter called the Obligee, in the sum of Dollars ($)
$....., for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, or heirs, executors, administrators, successors and assigns jointly and severally firmly by these presents.

OWNER
Howard County Public School System
10910 Clarksville Pike
Ellicott City, MD, 21042

WHEREAS the Principal has submitted a bid for

PROJECT:
(Name, location or address, and Project number, if any)

NOW, Therefor, if the Obligee shall accept the bid of Principal and the Principal shall enter into a Contract with the Obligee in accordance with the term of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to Obligee the difference not to exceed the penalty thereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.
(Paragraph deleted)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Init.
/

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

SECTION 00601
INSURANCE REQUIREMENTS

1 - General Insurance Requirements:

1.1 - The Contractor shall not commence Work until he has obtained at his own expense all of the insurance as required hereunder and such insurance has been approved by the Board of Education of Howard County Maryland; nor shall the Contractor allow any Subcontractor to commence Work on his subcontract until all similar insurance required of the Subcontractor has been so obtained and approved by the Contractor. Approval of insurance required of the Contractor will be granted only after submission to the Board of Education of Howard County Maryland of original, signed certificates of insurance or, alternately, at the Board of Education of Howard County Maryland's request, certified copies of the required insurance policies.

1.2 - The Contractor shall require all Subcontractors to maintain during the term of this agreement, commercial general liability insurance, business automobile liability insurance, and Workers' Compensation and employers' liability insurance, in the same manner as specified for the Contractor. The Contractor shall furnish Subcontractors' certificates of insurance to the Board of Education of Howard County Maryland immediately upon request.

1.3 - All insurance required hereunder shall include the following provision: "It is agreed that this policy is not subject to cancellation, non-renewal, material change, or reduction in coverage until sixty (60) days prior written notice has been given to the Board of Education of Howard County Maryland."

The phrases "endeavor to" and "... but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives" are to be eliminated from the cancellation provision of standard ACORD certificates of insurance.

1.4 - No acceptance and/or approval of any insurance by the Board of Education of Howard County Maryland shall be construed as relieving or excusing the Contractor, or the Surety, or his bonds, from any liability or obligation imposed upon either or both of them by the provisions of the Contract Documents.

1.5 - The Board of Education of Howard County Maryland and its elected or appointed officials, agents and employees are to be named as an additional insured under all coverages except Workers compensation and business automobile liability, and the certificate of insurance, or the certified policy, if requested, must so state this. Coverage afforded under this paragraph shall be primary as respects the Board of Education of Howard County Maryland, its agents and employees.

1.6 - The Contractor shall be responsible for the Work performed under the Contract Documents and every part thereof, and for all materials, tools, equipment, appliances, and property of any and all description used in connection with the Work. The Contractor assumes all risk for direct and indirect damage or injury to the property or persons used or employed on or in connection with the Work contracted for, and of all damage or injury to any person or property wherever located, resulting from the action, omission, commission or operation under the contract, or in connection in any way whatsoever with the contracted Work, until final acceptance of the Work by the Board of Education of Howard County Maryland.

1.7 - Insurance coverage required in these specifications shall be in force throughout the contract term. Should the Contractor fail to provide acceptable evidence of current insurance within seven days of written notice at any time during the contract term, the Board of Education of Howard County Maryland shall have the absolute right to terminate the contract without any further obligation to the Contractor, and the Contractor shall be liable to the Board of Education of Howard County Maryland for the entire additional cost of procuring performance and the cost of performing the incomplete portion of the contract at time of termination.

1.8 - Contractual and other liability insurance provided under this contract shall not contain a supervision, inspection or engineering services exclusion that would preclude the Board of Education of Howard County Maryland from supervising or inspecting the project as to the end result. The Contractor shall assume all

on-the-job responsibilities as to the control of persons directly employed by it and of the Subcontractors and any persons employed by the Subcontractor.

1.9 - Nothing contained in the specifications shall be construed as creating any contractual relationship between any Subcontractor and the Board of Education of Howard County Maryland. The Contractor shall be fully responsible to the Board of Education of Howard County Maryland for the acts and omissions of the Subcontractors and of persons employed by them as it is for acts and omissions of persons directly employed by it.

1.10 - Precaution shall be exercised by the Contractor at all times for the protection of persons, (including employees) and property. All existing structures, utilities, roads, services, trees and shrubbery shall be protected against damage or interruption of service at all times by the Contractor and its Subcontractors during the term of the contract, and the Contractor shall be held responsible for any damage to property occurring by reason of its operation on the property.

1.11 - If the Contractor does not meet the insurance requirements of the specifications, alternate insurance coverage, satisfactory to the Board of Education of Howard County Maryland, may be considered. Written requests for consideration of alternate coverages must be received by the Board of Education of Howard County Maryland at least ten Working days prior to the date set for receipt of bids or proposals. If the Board of Education of Howard County Maryland denies the request for alternate coverages, the specified coverages will be required to be submitted.

1.12 - All required insurance coverages must be acquired from insurers allowed to do business in the State of Maryland and acceptable to the Board of Education of Howard County Maryland. The insurers must also have a policyholders' rating of "A-" or better, and a financial size of "Class VII" or better in the latest edition of Best's Insurance Reports, unless the Board of Education of Howard County Maryland grants specific approval for an exception.

1.13 - The Board of Education of Howard County Maryland will consider any deductible amounts as part of its review of the financial stability the Contractor. Any deductibles shall be disclosed by the Contractor, and deductible amounts are the responsibility of the Contractor.

2 - Contractor's Liability Insurance - "Occurrence" Basis:

2.1 - The Contractor shall purchase the following insurance coverages:

2.1.1 - Commercial general liability with a minimum limit of $1,000,000 per occurrence, $1,000,000 annual aggregate including all of the following:

i. General aggregate limit is to apply per project;

ii. Premises/operations;

iii. Actions of independent Contractors;

iv. Products/completed operations to be maintained for two years after completion of the Work;

v. Contractual liability including protection for the Contractor from claims arising out of liability assumed under this contract;

vi. Personal injury liability including coverage for offenses related to employment;

vii. Explosion, collapse, or underground (XCU) hazards (confirmation of underground hazard coverage must be confirmed by either certificate of insurance or in writing by Contractor's agent, broker or insurer);

2.1.2 - Business automobile liability including coverage for any owned, hired, or non-owned motor vehicles and automobile contractual liability with a limit of $1,000,000 per accident; uninsured motorist coverage at minimum statutory limits.

2.1.3 - Workers compensation with statutory benefits as required by Maryland law or the U. S. Longshoremen's and Harbor Workers' Compensation Act, or other laws as required by labor union agreements, including standard other states coverage; employers' liability coverage with limits of $100,000 per accident, $100,000 per employee for disease, and a $500,000 disease policy limit.

2.1.4 - Total limit requirements of 2.1.1, 2.1.2 and 2.1.3 may be met by a combination of primary and umbrella excess liability coverage.

3 - Commercial General or Other Required Liability Insurance - "Claims Made" Basis

3.1 - If commercial general or other liability insurance purchased by the Contractor has been issued on a "claims made" basis, the Contractor must comply with the following additional conditions:

i. Agree to provide certificates of insurance evidencing the above coverages for a period of two years after final payment for the contract. Such certificates shall evidence a retroactive date, no later than the beginning of the Contractors' or Subcontractors' Work under this contract, or

ii. Purchase an extended (minimum two years) reporting period endorsement for the policy or policies in force during the term of this contract and evidence the purchase of this extended reporting period endorsement by means of a certificate of insurance or a copy of the endorsement itself.

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount: $

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company *(Corporate Seal)*
:

Signature
:
Name
and Title:
(Any additional signatures appear on the last page of this Payment Bond.)

SURETY
Company *(Corporate Seal)*
:
(Row deleted)

Signature
:
Name
and Title:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Init.
/

Drawings and Specifications prepared by:
(Architect name and address)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

Which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

LABOR AND MATERIAL PAYMENT BOND

Now therefore, the condition of this obligation is such that, if Principal shall promptly make payment to all claimants as hereinafter defined. For all labor and material used or presumably required for use in the performance of the Contract, then this obligation shall be void: otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, prosecute the suit for final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

   a) Unless claimant, other than on having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety(90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

   b) After the expiration of one (1) year following the date on which Principal ceased Work on seaside Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

   c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United

States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens with may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
		Address:	
Address:			

(Table deleted)(Paragraphs deleted)

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ NONE ☐ SEE SECTION 16

CONTRACTOR AS PRINCIPAL		SURETY	
COMPANY:	*(CORPORATE SEAL)*	COMPANY:	*(CORPORATE SEAL)*
SIGNATURE:		SIGNATURE:	
NAME AND TITLE:		NAME AND TITLE:	

IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS PREPARED BY:
(HERE INSERT FULL NAME AND ADDRESS OR LEGAL TITLE OF ARCHITECT)

(Table deleted)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

Which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

PERFORMANCE BOND

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.
The surety hereby waives notice of any alteration of extension of time made by the Owner.
Whenever Contractor shall be, and declare by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

1. **Complete the contract in accordance with is terms and conditions, or**

2. **Obtain a bid or bids for competing the Contract in accordance with is terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph , shall mean the total amount payable by Owner to Contactor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.**

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

Signed and sealed this day of

_____ _____
(Witness) (Principal) (Seal)

_____
(Witness) (Title)

(Table deleted)(Paragraphs deleted)

AIA® Document A201® – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name and address)

THE ARCHITECT:
(Name and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

Init.
/

INDEX
(Numbers and Topics in Bold are Section Headings)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Wherever in the Specifications there appears a reference to a "Contractor" or the "Subcontractor" or a reference to a Contractor, installer or supplier of a particular trade, or for a particular type of Work, such reference, regardless of the language hereof shall be deemed a reference to the Contractor and shall not be construed as relieving the Contractor from the duty to perform all of the Work and other obligations provided under the Contract.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings.. Unless otherwise indicated, the Architect shall be deemed the author of the Specifications and other documents prepared by the Architect. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Owners copyrights or other reserved rights. The Drawings, Specifications, and other documents are and shall always be the property of the Owner, and the Owner shall retain all common law, statutory, and other reserved rights in addition to copyright.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 1 The Owner is the Board of Education of Howard County Maryland identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 2 The Contractor understands that the Board of Education of Howard County, Maryland, is a public agency, and no mechanics' liens are permitted against its property.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Deleted

§ 2.2.2 Except for permits and fees, including those required under Section 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction,

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site to the extent reasonably required for execution of the Work and requested by the Contractor in writing within one (1) month of the date of Contract.The Owner does not warrant or undertake responsibility for the location of utilities or the accuracy of tests concerning the soil, surface, and subsurface conditions. .

§ 2.2.4 Information or services under the Owner's control shall, be furnished by the Owner after receipt from the Contractor of a written request for such information or services..

(Paragraph deleted)

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, Three (3) sets of copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

§2.3.1 If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. This right shall be in addition to an not in restriction or derogation of the Owners' rights under Section 4.3.4 and under Article 14 of the General Conditions.

§2.3.2 If unforeseen conditions occur or are encountered which may substantially impair the quality of the Work unless the Work is suspended, the Owner may suspend the Work by notice in writing to the Contractor. In the event of such a suspension, Contractor shall be entitled only to payment for work actually completed up to and including the date on which the work was suspended by the Owner. In any event where the Contractor reasonably determines that a suspension is required in such circumstances, the Contractor shall promptly notify in writing the Owner and Architect of such determination. In the event the Owner agrees to suspend the work, the Contractor shall only be entitled to payment for work actually completed up to and including the date on which the work was suspended.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, upon written notice to the Contractor at the

conclusion of the above referenced seven day period without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. , upon written notice to the Contractor at the conclusion of the above referenced seven-day period, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect's and their respective consultants' additional services and expenses made necessary by such default, neglect or failure. At the election of the Owner, the first written notice to the Contractor to correct defective work may also contain written notice that if the defective work or other specified cause for termination is not corrected, cured, or remedied to Owner's satisfaction, then Owner may issue a written notice to Contractor at the end of the above reference seven (7) day period terminating the Contractor's employment under the Contract pursuant to Article 14 of these General Conditions. In the event the Owner elects to terminate the Contractor's employment under this Contract, the Contractor shall only be entitled to payment for work under the Agreement actually completed by the Contractor up to the date of Contractor's termination, less deductions for: (1) the cost of correcting any deficient or defective work, including compensation for the Architect and their respective consultant's additional services and expenses made necessary by the Contractor's defective work, default, neglect, or failure to perform under this Contract; (2) damages incurred by the Owner as a result of the Contractor's breach, including but not limited to costs to finish the work and damages for delay, if any, in completing the work under the Contract; and (3) actual reasonable attorney's fees incurred by the Owner in obtaining legal advice, counsel, and/or representation relating to the issues of Contractor's breach of contract, defective work, default neglect, or failure to perform and Owner's legal options relating thereto as well as any other reasonable attorney's fees due to Owner under other provisions of this Contract; and (4) such other amounts due and owing to Owner under the terms and conditions of the Contract documents. In the event the Contractor is terminated pursuant to Article 14.2, the Contractor shall not be entitled to any remaining funds under the Contract after the date of termination except as specifically provided above, and subject to the availability of funds after all work is completed. All remaining unpaid funds in the Contract as of the Contractor's termination date shall be the sole and exclusive property of the Owner, and the Contractor shall be paid by the Owner at the conclusion of all work under the Contract as provided above, but only to the extent that there are funds remaining after all payments have been made to complete the work under the Contract and to compensate the Owner as provided above in the four (4) enumerated deductions in this Article 2.4.1. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 . 1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative. When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the contractor who executes each separate Contractor Agreement.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 The Contractor warrants that it has made itself familiar with the Project site and obtained all information required by the Contractor concerning the conditions of the Project site including but not limited to soil, surface, and subsurface conditions, legal descriptions and surveys of the Project site, and the location of utilities and the improvements to be constructed. The Contractor shall continue to carefully study and compare the Contract Documents with each other and with information obtained by Contractor by his own investigation and tests and shall at once report to the Owner and Architect errors, inconsistencies, or omissions discovered. These obligations are for

Init.

the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require. If the Contractor performs any construction activity with either actual knowledge or constructive knowledge that it involves an error, inconsistency, or omission in the Contract Documents, the Contractor shall assume liability for such performance and costs for correction.

§ 3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect. If the Contractor performs any construction activity with either actual knowledge or constructive knowledge that it involves an error, inconsistency, or omission in the Contract Documents, the Contractor shall assume liability for such performance and costs for correction.

§ 3.2.3 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect. If the Contractor performs any construction activity with either actual knowledge or constructive knowledge that it involves an error, inconsistency, or omission in the Contract Documents, the Contractor shall assume liability for such performance and costs for correction.

§ 3.2.4 Delete.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, . The Contractor shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents by activities or duties of the Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.3.4 All inspections required by law shall be obtained by the Contractor, including but not limited to those required by law to be obtained by the Owner, and no failure of the Owner to obtain such inspection shall constitute a waiver of Contractor's obligation hereunder. The Contractor shall notify the Owner of any application for inspection required to be executed by the Owner.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Delete

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§3.4.4 By law, all school sites are drug, alcohol, and tobacco free, and Contractor shall ensure that all workers on the job site comply with the said law.

§ 3.5 WARRANTY

§ 3.5.1 The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of excellent quality and new unless otherwise required or permitted by the Contract Documents, that the Work shall be performed in an excellent manner and shall be free from defects , and that the Work shall conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective. The Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received. . The Owner will not reimburse the Contractor for the cost of elective permits, which the Contractor chooses to secure in conjunction with its means and methods of executing the work, or for any offsite permits.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 The Contractor shall review the Contract Documents to ascertain that the Contract Documents are to the best of the Contractor's knowledge in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. The Contractor shall promptly notify the, Architect and Owner in writing, of any variance therewith, and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.4 If the Contractor performs Work contrary to laws, statutes, ordinances, building codes, and rules and regulations , the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

(Paragraph deleted)
§ 3.8 Deleted

(Paragraphs deleted)
§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Project conference meeting minutes shall constituted Owner's request in writing .The Owner shall have the right to require the Contractor

to replace any superintendent whose performance the Owner deems to be unsatisfactory, and the Contractor's failure to do so within seven (7) days of having received written notice from the Owner as to the Superintendent's unsatisfactory performance shall constitute a breach of Article 14.2.1, thereby giving the Owner the right to terminate the Contractor's employment under this Contract.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall promptly prepare and submit for the Owner's and Architect's approval a proposed Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, but shall not extend the original completion date and shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare and keep current, for the Architect's/Owners review, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time to review submittals.

(Paragraph deleted)

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner in good condition upon completion of the Work and before final payment is made and shall be executed by the Contractor certifying that they have been kept in accordance with the provisions of this subparagraph and accurately reflect the construction of the Work as built.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals,. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor

except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

(Paragraph deleted)

§3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect and Owner engaged Testing Agencies access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor. The Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to reasonable attorneys' fees and litigation expenses incurred by the Owner, and arising out of or resulting from performance of the Work, defective work, default, neglect, and or failure to perform under the Contract. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Engineer or the Architect's or Engineer's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect whose status under the Contract Documents shall be that of the former Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

(Paragraph deleted)

§ 4.2.1. The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one or two year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's/Owner's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive, review for completeness and forward to the Owner, records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.2.10 Delete

§ 4.2.11 The Architect will interpret and decide matters concerning performance under and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing with reasonable promptness

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect will endeavor to secure faithful performance by the Contractor

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor. . Under no circumstances shall the Contractor subcontract any portion of the work under the Contract Documents to any person or entity in which the Contractor (including any officer and/or stockholder of the Contractor) has an ownership interest. Under no circumstances shall the Contractor assign or otherwise contract with another person or entity to assume the Contractor's obligations and duties as Contractor under these Contract Documents

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Within thirty (30) days of the award of the Contract, the Contractor shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection. Subcontractors, required to be named on the Bidding Documents, shall be used on the Work for which they are proposed, unless reasonable objection is indicated by the Owner, or the Architect.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected without approval of the Owner.

§ 5.3 SUBCONTRACTUAL RELATIONS

§5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 ,or stoppage of the Work pursuant to Article 2.3, and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing;.

(Paragraphs deleted)

§5.5 PAYMENTS TO SUBCONTRACTORS

§5.5.1 The Contractor shall pay each subcontractor upon receipt of payment from the Owner, an amount equal to the percentage of completion allowed to the Contractor on account of each Subcontractor's work less the percentage retained for payments to the Contractor. The Contractor shall also require each Subcontractor to make similar payments to its Sub-subcontractors.

§5.5.2 If the Owner fails to approve a Requisition for Payment for a cause which the Owner determines is the fault of the Contractor and not the fault of a particular Subcontractor, or if the Contractor fails to make a payment which is properly due to a particular Subcontractor, the Owner may pay each Subcontractor directly less the amount to be retained under the Subcontract. Any amount so paid by the Owner shall be repaid to the Owner by the Contractor in the manner set forth in Subparagraph 2.4

§5.5.3 The Owner shall have no obligation to pay or see to the payment of any monies to any Subcontractor. Nothing contained in Article 5.5 shall be deemed to create any rights in any Subcontractor against the Owner.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

(Paragraph deleted)

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor.

§ 6.2.4 The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

(Paragraph deleted)

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall not relieve the Contractor of obligations under the contract. .

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 an amount of the adjustment, if any, in the Contract Sum; and
.3 the extent of an adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

(Paragraphs deleted)

§ 7.3.9 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 CHANGE ORDERS

§ 7.4.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

.1 change in the Work; and/ or

.2 an amount of the adjustment, if any, in the Contract Sum; and/or

.3 the extent of an adjustment, if any, in the Contract Time.

§ 7.4.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.5 MINOR CHANGES IN THE WORK

§ 7.5.1 The Architect with concurrence from the Owner will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the purposes of the building and the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work. .

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§8.2.4 Should the progress of the Work be delayed by any fault, neglect, act or omission of the Contractor or any person or firm employed by him or should it be necessary to complete the Work within the time permitted for the Contractor's work, the Contractor shall, at its own cost and expense, work such overtime as may be necessary to make up for all time lost and to avoid delay in completion of the Work. The Contractor shall compensate the Owner for and hold him harmless against any and all costs, expenses, reasonable attorney's fees, losses, liability, and damages that the Owner may sustain or incur by reason of such delay.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

(Paragraph deleted)

§ 8.3.1. Requests for extension of completion time due to conditions over which the Contractor has no control, will be reviewed by the Owner after written application is made to the Architect for a time extension. Any request for any extension of time is to be made within 21 days of occurrence of conditions which, in the opinion of the Contractor

warrant such an extension, with reasons clearly stated and detailed proof given for all delays beyond the Contractor's control. No time extension will be allowed except by written and specific approval of the Owner. Delays beyond the Contractor's control may include: an act or neglect of the Owner's own forces, Architect, any of the other Contractors, or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, or other causes beyond the Contractor's control, or by delay authorized by the Owner.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

(Paragraph deleted)

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 Before the first Requisition for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Requisitions for Payment.

§ 9.3 3 REQUISISTION FOR PAYMENT

§ 9.3.1 The Contractor shall prepare and submit three original copies to the Architect on the 25th day of each month itemized "Requisition for Payment" (IAC PSCP Form 306.4 Standard Contractor's Requisition for Payment and such other forms as may be designated by Owner) for operations completed in accordance with the Schedule of Values for the value of the work completed or anticipated to be completed through the last day of such month, including the value of material suitably stored at the Project Site or other approved locations as provided in Subparagraph 9.3.2, less the aggregate of any previous payments and retainages and less retainages required by the Contract Documents. No change in the Contract Sum shall be made by Contractor on any Requisition for Payment without an approved Change Order. Faxed Requisitions for payment will NOT be accepted.
At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

(Paragraphs deleted)

§ 9.3.2 As provided in Section 7.3.8, such Requisitions may include requests for payment on account of changes in the Work which have been properly authorized by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.3 Such Requisitions may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

9.3.4 Upon completion of fifty percent (50%) of the work and provided that the Contract work is on schedule and the Contractor's performance is deemed by the Owner to be satisfactory, the Owner may at his discretion decline to withhold further retainage on the remainder of the work to be billed. If Project schedules are not pursued diligently, or if the Contractor's work is at any time deemed by the Owner to be unsatisfactory, the withholding of the further retainage up to ten percent (10%) of the Contract value may be reinstated by the Owner at its discretion. If the Contractor intends to request a reduction of retainage as stated above, the Contractor must submit a request 30 days prior to invoicing the Owner for a reduction. A consent of surety to a reduction of retention along with a justification of the progress on the job in relation to the overall Project must be submitted. A complete labor and material schedule of values for all aspects of the work must also be submitted with the request for approval.

§ 9.3.5 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. . When the Requisition for Payment includes material or equipment stored off the Project site, the Contractor shall include with the requisition a certified statement including

1. Description of items,
2. Bill of Sale,
3. Location of storage facility and delivery receipt,
4. Items are currently covered by all contractual requirements, including liability and fire insurance,
5. Items, or any part thereof will not be installed in other construction projects other than work under this Contract.

§ 9.3.6 The Contractor warrants that title to all Work covered by a Requisition for Payment shall pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of a Requisition for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work. Contractor shall indemnify and hold Owner harmless from any liens, claims, security interests, or encumbrances claimed by Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work and from all costs and expenses, including reasonable attorney's fees, incurred by Owner in connection therewith.

§ 9.3.7 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.8 Deleted

§ 9.3.9The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Requisition for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The Architect shall endeavor to obtain approval by the Owner, and Contractor of the draft Requisition for Payment. If approval is obtained, the Architect shall notify the Owner, and Contractor, and shall issue a Project Certificate of Payment. The Contractor shall then submit five (5) copies of the agreed upon Requisition for Payment to the Architect which shall be signed by the Contractor, Owner, and Architect, and shall be notarized. If approval is not obtained of the draft Requisition for Payment, the Architect shall notify the Contractor of non-approval. The Architect shall issue a Project Certificate for Payment to the Owner with a copy to the to the Contractor for such amounts as the , Architect, and Owner determine are properly due.. The Contractor shall then submit a Requisition for Payment pursuant to such Project Certificate for Payment, if any, in five (5) copies based on the Architect's determination. The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner,

based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has
(1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work,
(2) reviewed construction means, methods, techniques, sequences or procedures,
(3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or
(4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.4.3 In any event, where the Owner, and Architect do not certify payment or withhold certification to any extent, the Contractor shall nonetheless continue to perform the Work fully.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

(Paragraphs deleted)
§9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or another contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 persistent failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

(Paragraph deleted)
§ 9.6 PROGRESS PAYMENTS
(Paragraphs deleted)
§ 9.6.1 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.2 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.3 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.4 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.1, 9.6.2 and 9.6.3.

§ 9.6.5 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.6 Under no circumstances shall the Contractor assign to any person or entity the Contractor's right to receive payment under the Contract Documents, unless the Contractor has received express, prior written consent of the Owner, which consent specifically identifies the identity of such assignee. Nothing contained in these Contract Documents shall require the Owner to approve such an assignment of payments by the Contractor to a third party.

§ 9.6.7 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.7 FAILURE OF PAYMENT

§ 9.7.1.If the Architect should fail to issue notice of approval or disapproval within fourteen (14) days of Owner's receipt of the Contractor's draft Requisition for Payment, or if, through no fault of the Contractor, the Architect does not issue a Project Certificate for Payment within seven (14) days after receipt of the Owner's approval or disapproval of the draft Requisition for Payment, the Contractor may file a claim against the Owner for payment as provided in Article 15.

§ 9.8 SUBSTANTIAL COMPLETION

(Paragraph deleted)
§9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use; i.e., when the Owner is granted a "Use and Occupancy Permit" by Howard County and other Authorities having jurisdiction.

§ 9.8.2 When the Architect, and Owner agree that the project has reached "Substantial Completion" as set forth in Paragraph 9.8.1 and is on schedule, and it appears that there are no complications or problems in completing the job, the retainage may be reduced to five percent (5%) at the Owner's discretion.

9.8.3 Except as stated in Paragraph 9.8.2 after the payment due the Contractor at Substantial Completion has been made by the Owner, no other payment shall be made until the Project has been fully completed and the Contract fully performed.

(Paragraph deleted)
§ 9.8.4 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.5 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.6 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.7 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Requisition for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect
(1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied,
(2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner,
(3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents,
(4) consent of surety, if any, to final payment with AIA Form; and
(5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner and release of liens on the "Contractor's Affidavit of Release of Liens and Payment of Debts and Claims" AIA Form;

(6) all records, Drawings and Specifications, Addenda, Change Orders, and other modifications maintained at the site under the Subparagraph 3.11 all warranties, instructions, and maintenance manuals required.
If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien or claim . If such lien or claim remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien or claim, including all costs and reasonable attorneys' fees incurred by Owner. Final payment to the Contractor shall not become due until all close-out documents have been properly submitted to and received by the Architect through the Construction Manager and certified to the Architect and delivered by the Architect to the Owner and all warranty work has been fully completed.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4
(Paragraphs deleted)
Deleted

§ 9.10.5 5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Requisition for Payment.
The making of final payment shall, after the Date of Substantial Completion of the Project, constitute a waiver of all claims by the Owner except those arising from:
1. Unsettled claims,

2. Faulty or defective work appearing after Substantial Completion of work,
3. Failure of the work to comply with the requirements of the Contract Documents,
4. Terms of any special warranties required by the Contract Documents; and
5. Reasonable attorney's fees, court costs, and litigation expenses incurred by the Owner in prosecuting any such claims against the Contractor or in defending against any claims against the Owner arising out of the Contract and the work thereunder.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY , INJURY OR DAMAGE TO PERSON OR PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, 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 sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2., except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction site to be loaded so as to endanger its safety or the safety of persons or property. The Contractor shall protect adjoining properties, streets, walkways, sidewalks, and paths.

10.2.8 The Contract shall protect excavation and structures from damage by rain, water, ground water, or water from any other source. The Contract shall use tarpaulins, pumps, or other temporary protection to afford protection.

10.2.9 The Contractor shall provide constant protection to maintain work, materials, apparatus, and fixtures free from injury and damage by rain, snow, wind, storms, frost, or heat and shall cover work likely to be damaged at the end of each day's work.

10.2.10 The Contractor shall remove work damaged due to failure to provide specified protection and replace such removed work at no additional cost to the Owner.

10.2.11 Material Safety Data Sheets: Contractor shall provide Material and Data Safety Sheets on all items prior to commencement of Work. The Contractor shall designate a common location on the construction site where all independent contractors or employers shall have a chemical information list before the commencement of work.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

(Paragraph deleted)

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 The Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately.

§ 10.3.3 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.

(Paragraphs deleted)

§ 10.4 EMERGENCIES

(Paragraph deleted)

§ 10.4.1 In any case of an emergency, the Contractor shall immediately notify the Architect and the Owner by the most expeditious means available, followed by a Fax, or written notice, explaining the situation and actions taken.

§ 10.4.2 Additional compensation or extension of time will not be considered or permitted for emergencies arising from delay, damage, or loss as stipulated in 8.2.4 and 10.2.5 or other applicable provisions.

ARTICLE 11 INSURANCE AND BONDS

§ 11.2 GENERAL INSURANCE REQUIREMENTS

§11.2.1 The Contractor shall not commence Work until the Contractor has obtained at the Contractor's own expense all of the insurance as required under this Contract and until such insurance has been approved by the Owner. The Contractor shall not allow any Subcontractor to commence work on any subcontract until all insurance required of the Subcontractor has been so obtained and approved by the Contractor. Approval of insurance required of the Contractor will be granted only after submission to the Owner of original certificates of insurance signed by authorized representatives of the insurers or, at the Owners request, certified copies of the required insurance policies. **Additionally, the Contractor must submit with the original certificates or certified policies, the enclosed Contractor's Insurance Checklist form (See Construction Insurance Check List attached to and incorporated into this Contract as Exhibit A.) completed by the Contractor and each of the Contractor's Insurance Agents or Contractor's Insurers (one form for each agent or insurer if multiple agents or insurers write the Contractor's coverages).**

§11.2.2 Insurance as required under this Contract shall be in force throughout the term of this Contract and for two years after final acceptance of the Project by Owner. Original certificated signed by authorized representatives of the insurers or, at the Owner's request, certificated copies of insurance policies, evidencing that the required insurance is in effect, shall be maintained with the Owner throughout the term of the Contract and for two years after final acceptance of the Project by Owner.

§11.2.3 The Contractor shall require all Subcontractors to maintain during the term of the Contract commercial general liability insurance, business auto liability insurance, and workers compensation and employers liability insurance and umbrella excess or excess liability insurance to the same extent required of Contractor in Sections 11.3.1.1 through 11.3.1.4 of this Contract unless any such requirement is expressly waived or amended by the Owner in writing. The Contractor shall furnish Subcontractor's certificates of insurance to the Owner immediately upon request.

§11.2.4 All insurance policies required under this Contract shall be endorsed to provide that the policy is not subject to cancellation, non-renewal, or material reduction in coverage until sixty (60) days prior written notice has been given to the Owner. Therefore, the phrases "endeavor to" and "...but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives" are to be eliminated from the cancellation provision of standard ACORD certificates of insurance.

§11.2.5 Acceptance and/or approval of any insurance by the Owner shall not be construed as relieving or excusing the Contractor or the Contractor's Surety from any liability or obligation imposed upon either or both of them by the provisions of this Contract or the Contract documents.

§11.2.6 If the contractor does not meet the insurance requirements of this Contract, the Contractor shall be in default under this Contract, and all default remedies shall be available to the Owner; moreover, no Work shall commence without such insurance, and, if Work has commenced, it shall cease immediately until the insurance requirements have been met or unless the Owner orders in writing that Work shall commence with specified alternate insurance as determined in the sole and absolute discretion of the Owner and set forth in the written order to commence or return to work signed by the Owner. The Contractor may forward a written request to the Owner for a waiver in writing of the insurance requirement(s) not met or for approval in writing of alternate insurance coverage, self-insurance, or group self-insurance arrangements. If the Owner denies the request, the Contractor shall comply with the insurance requirements as specified in this Contract or be held in default under this Contract. The Owner shall have the sole and absolute discretion to grant or deny such a request for a waiver, and the Owner's decision shall be final and binding upon all parties and shall not be subject to appeal or review.

§11.2.7 All required insurance coverages must be underwritten by insurers licensed to do business in the State of Maryland and acceptable to the Owner. The insurers must also have a policyholders' rating of "A" or better, and a financial size of "Class VII" or better in the latest evaluation by A.M. Best company, unless Owner grants specific written approval for an exception. The Owner hereby grants specific approval for the acquisition of workers compensation and employers liability insurance from the Injured Workers Insurance Fund of Maryland.

§11.2.8 Any deductibles or retentions in excess of $10,000 shall be disclosed by the Contractor and shall be subject to Owner's written approval. Any deductible or retention amounts elected by the Contractor or imposed by the Contractor's insurer(s) shall be the sole responsibility of the Contractor.

§11.2.9 Any and all return premiums and/or dividends for insurance or coverage directly charged to the Owner by the Contractor in connection with this Contract shall belong to and be payable to the Owner.

§11.2.10 If the Owner is damaged by the failure or neglect of the Contractor to purchase and maintain insurance as described and required in this Contract, then the Contractor shall be in default under this Contract, shall bear all liability for all damages incurred, and shall be subject to the remedies under Article 14.

§ 11.2.11Owner's Liability Insurance

§11.2.11.1 Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance, or solely at the Owner's option, the Owner may self-insure the Owner's liability exposures.

§11. 3 Contractor's Liability Insurance

§ 11.3.1 The Contractor shall purchase and maintain the following insurance coverages which will insure against claims which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone, directly or indirectly, employed by any of them, or by anyone for whose acts any of them may be liable. Insurance shall be written for not less than the limits specified below or required by law, whichever is greater.

§11.3.2 Commercial general liability insurance or its equivalent for bodily injury, personal injury and property damage including loss of use, with minimum limits of:

$ 1,000,000 each occurrence;

$ 1,000,000 personal and advertising injury;

$ 2,000,000 general aggregate; and

$ 2,000,000 products/completed operations

aggregate.

This insurance shall include coverage for all of the following:

i. General aggregate limit applying on a per project basis;

ii. Liability arising from premises and operations;

iii. Liability arising from the actions of independent contractors;

iv. Liability arising from products and completed operations with such coverage to be maintained for two years after final acceptance of the project by the Owner;

v. Contractual liability including protection for the Contractor from bodily injury and property damage claims arising out of liability assumed under this Contract; and

vi. Liability arising from the explosion, collapse, or underground (XCU) hazards.

(Paragraph deleted)

§11.3.3 Business auto liability insurance or its equivalent with a minimum limit of $1,000,000 per accident and including coverage for all of the following:

i. Liability arising out of the ownership, maintenance, or use of any auto; and

ii. Automobile contractual liability.

§11.3.4 Workers compensation insurance or its equivalent with statutory benefits as required by any state or Federal law, including standard "other states" coverage; employers liability insurance or its equivalent with minimum limits of:

$ 100,000 each accident for bodily injury by accident

$ 100,000 each employee for bodily injury by disease; and

$ 500,000 policy limit for bodily injury by disease.

(Paragraphs deleted)

§11.3.5 Contractor's pollution liability insurance or its equivalent for bodily injury, property damage, including loss of use, and clean-up costs on and off the Project site, with minimum limits of:

$ 1,000,000 each pollution incident; and

$ 1,000,000 annual aggregate.

The insurance shall include coverage for all of the following:

i. Liability arising from activities of the Contractor or of others for whom the Contractor is legally obligated whether on or off the Project site; and

ii. Contractual liability including protection for the Contractor from claims for bodily injury, property damage, and clean-up costs arising out of liability assumed under this Contract.

11.3.6 Umbrella excess liability or excess liability insurance or its equivalent with minimum limits of:

$ 5,000,000 occurrence;

$ 5,000,000 aggregate for other than products/completed operations and auto liability; and

$ 5,000,000 products/completed operations aggregate

and including all of the following coverages on the applicable schedule of underlying insurance:

i. Commercial general liability;

ii. Business auto liability; and

iii. Employer's liability.

§11.3.7 Owner and Owner's elected and appointed officials, officers, consultants, agents and employees shall be named as additional insureds on the Contractor's commercial general liability insurance and umbrella excess or excess liability insurance policies with respect to liability arising out of the Contractor's products, installation, and/or services provided under this Contract. Such coverage shall extend to cover the additional insured(s) for liability arising out of the following:

i. On-going operations;

ii. Owner's general supervision of installation and/or services as provided by the Contractor and/or its agents and subcontractors pursuant to this Contract; and

iii. Products and completed operations.

The commercial general liability policy and the umbrella excess liability or excess liability policies must include additional insured language, which shall afford liability coverage for all of the exposures listed above in i., ii., and iii., as follows:

"This policy is amended to include as insureds Owner and Owner's elected and appointed officials, officers, consultants, agents, and employees, but only for liability arising out of "your product" and "your work" for Owner by or for you."

Special Note: ISO forms CG 2009 and CG 2010 entitled "Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization" (previously Forms A and B respectively) and CG 2033 entitled "Additional Insured – Owners, Lessees or Contractors – Automatic Status When Required in Construction Agreement with You" are *NOT ACCEPTABLE.* A manuscript endorsement with the above wording is required.

(Paragraph deleted)

§ 11.3.8 Insurance or self-insurance provided to the Owner and Owner's elected and appointed officials, officers, consultants, agents and employees under the Contractor's liability insurance or self-insurance required in this Contract, including, but not limited to, umbrella and excess liability or excess liability policies, shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of insurance or self-insurance. (Any cross suits or cross liability exclusion shall be deleted from Contractor's liability insurance policies required herein.)

§11.3.9 Any insurance or self-insurance required to be provided by the Owner and Owner's elected and appointed officials, officers, consultants, agents, and employees shall be primary, and any other insurance, self-insurance, coverage or indemnity available to the Owner and Owner's elected and appointed officials, officers, consultants, agents, and employees shall be excess of and non-contributory with insurance or self-insurance provided to the Owner and Owner's elected and appointed officials, officers, consultants, agents, and employees.

(Paragraph deleted)

§11.3.10 If any liability insurance purchased by the Contractor has been issued on a "claims made" basis, the Contractor shall comply with the following additional conditions:

i. The Contractor shall agree to provide certificates of insurance evidencing the above coverages for a period of two years after final payment for the Contract. Such certificates shall evidence a retroactive date no later than the beginning of the Work under this Contract; or

ii. The Contractor shall purchase an extended (minimum two years) reporting period endorsement for each such "claims made" policy in force as of the date of final acceptance of the project by the Owner and evidence the purchase of this extended reporting period endorsement by means of a certificate of insurance or a copy of the endorsement itself. Such certificate or copy of the endorsement shall evidence a retroactive date no later than the beginning of the Work under this Contract.

(Paragraph deleted)

§ 11.4 Builders Risk Insurance (Owner to Purchase)

§ 11.4.1 The Owner shall purchase and maintain builders risk insurance on a replacement cost basis with a limit at least equal to the initial Contract Sum. This insurance shall be maintained until final acceptance of the Project by the Owner or until no person or entity other than the Owner has an insurable interest in the covered property, whichever is earlier. This builders risk insurance shall include the interests of the Owner, Subcontractors and Sub-subcontractors in the Project.

(Paragraphs deleted)

§11.4.2 Insurance shall be on an "all-risk" or equivalent policy form and shall insure against the perils of fire, extended coverage, theft, vandalism, malicious mischief, collapse and windstorm. Coverage is to apply for debris removal, including demolition occasioned by a covered loss. This insurance shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such covered loss. Coverage for other perils such as flood and earthquake or for loss caused by the enforcement of any applicable ordinance or law shall not be required unless otherwise provided in the Contract.

§ 11.4.3 This builders risk insurance shall cover all of the following types of property:

i. All structures to be constructed, under construction, and/or already constructed;

ii. All materials, equipment, machinery and supplies which are to be incorporated into the Project;

iii. Temporary structures of any nature whatsoever; and

iv. Underground property, including but not limited to, foundations, pump stations, pumps, pipes, drains, tanks and connections.

(Paragraph deleted)

§11.4.4 The Contractor shall be responsible for payment of any deductibles applicable under this builders risk insurance, boiler and machinery insurance, or other property insurance applicable to the Project.

§ 11.4.5 Unless otherwise provided in the Contract Documents, this builders risk insurance shall cover materials to be incorporated into the Project, which are either on or off the site, and also such materials in transit.

(Paragraph deleted)

§ 11.4.6 This builders risk insurance shall insure (or shall be amended to insure) against loss or damage caused by the boiler and machinery perils with limits and scope of coverage that are deemed by the Owner to be satisfactory. This insurance shall also include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project.

(Paragraph deleted)

§11.4.7 The Owner and Contractor waive all rights against each other and against the Construction Manager, Owner's other Contractors and own forces described in Article 6, if any, and the subcontractors, sub-subcontractors, (elected and appointed officials, officers, directors, trustees, agents, employees and consultants) of any of them for property damage to or loss of use of the Work to the extent that such property damage or loss of use is covered by this builders risk insurance, boiler and machinery insurance, or other property insurance applicable to the Work. The policies shall provide such waivers of subrogation by endorsement or otherwise.

(Paragraph deleted)

§11.4.8 Any loss covered under this builders risk insurance, boiler and machinery insurance, or other property insurance applicable to the Work shall be payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to any mortgagee clause. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

(Paragraph deleted)

§ 11.4.9 Owner, as fiduciary, shall have the power to adjust and settle a loss with insurers.

(Paragraphs deleted)

§11.4.10 Partial occupancy or use in accordance with the provisions of the Contract that pertain to partial occupancy or use shall not commence until the builders risk insurer has granted permission by endorsement or otherwise for the Owner to partially occupy or use any completed or partially completed portion of the Work at any stage of construction. The Owner and Contractor shall take reasonable steps to obtain such permission.

(Paragraphs deleted)

§11.4.11 The insurance required by this Paragraph 11.4 is not intended to cover machinery, tools, or equipment owned or rented by the Contractor or its Subcontractors, which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor and its Subcontractors shall, at their own expense, purchase and maintain property insurance coverage for owned, leased, or rented machinery, tools or equipment. The Contractor and its Subcontractors hereby waive all rights against the Owner and its elected and appointed

officials, officers, agents, employees, and consultants for property damage to or loss of use of such machinery, tools, or equipment. The policies shall provide such waivers of subrogation by endorsement or otherwise.

§11.5 Miscellaneous Insurance

§11.5.1 The Contractor shall comply with the provisions of Federal law governing Social Security and with State and/or Federal laws regarding Unemployment Insurance, and all other State and/or Federal laws regarding insurance, as may be now and hereafter in force. The Contractor shall bear exclusive and sole liability for and will hold the Owner harmless against any and all demands for any required payments, taxes, or withholdings (including any interest or penalties assessed thereon) for the Contractor's (or any of its Subcontractor's) failure or refusal to comply with any such laws. Failure to comply shall be deemed a default subject to the remedies of Article 14.2.

§ 11.6 PERFORMANCE BOND AND PAYMENT BOND

§ 11.6.1 The Contractor shall furnish a Performance Bond and Labor and Materials Payment Bond covering the faithful performance of the Contract and the payment of all obligations arising thereunder and complying with the requirements of Maryland Law. Both bonds shall be in the amount of one hundred percent (100%) of the Contract amount and shall name the Howard County Board of Education as Obligee.
§ 11.6.2
Bonds shall be written by a bonding company that must be licensed with the Maryland Insurance Administration to do business in the State of Maryland and otherwise acceptable to the Howard County Public School System. The Contractor shall use Bond Forms provided by the Owner AIA 312 Performance Bond and AIA 312 Labor and Material Payment Bond, in order to satisfy the Bond requirements referenced in this Article.

§ 11.6.3 Firms issuing said bonds must be licensed to write bonds in the State of Maryland. The Contractor shall pay the premiums for required bonds. Obtainage of the required bonds by Contractor shall be a condition precedent to effectuation of the Contract between Owner and Contractor. If additional work is authorized, the amounts of the bonds shall be increased to cover the value of the increased Contract sum. All bonds shall conform to the requirements of the Maryland Little Miller Act. All bonds shall be subject to Owner's approval.
§ 11.3.4 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

(Paragraphs deleted)
§ 11.3.5 Owner reserves the right to request from Contractor financial statements for the Contractor for up to 3 prior fiscal years.

§ 11.3.6 To protect the public interest the Owner will request a D & B report on the Contractor at any time during the term of the project. Should the D & B rating fall below the awarded rating, Contractor shall advise Owner of their corrective measures.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If any portion of the Work is covered contrary to the request of the Architect, or the requirements specifically expressed in the Contract Documents, it must, if required in writing by either, the Owner or any other government agency, be uncovered for their observation and shall be replaced at the Contractor's expense without change in the Contract Time If a portion of the Work is covered contrary to the Architect's request or to requirements specifically

expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense.

§ 12.2 CORRECTION OF WORK

§12.2.1 Defective work shall include but not be limited to Work which may be caused by deterioration or failure to perform due to premature wear (not occasioned by abuse) or inherent defects in materials, workmanship of manufacturer or fabrication or improper execution of work

§12.2.2 Cost of correcting such rejected work also includes all contingent damages arising there from including damages to other work (whether installed by the Contractor or another) and to other property of the Owner.

§12.2.3Such warranties as provided herein do not deprive the Owner of the Owner's right to prosecute any claim for breach of contract and/or any other claim for appropriate relief and damages.

§12.2.4 Any defective or nonconforming work during this period causing a hazard to life, safety, property, or use causing the Owner a financial loss shall be corrected immediately without regard to normal working hours. The Owner will immediately endeavor to provide telephone notice to the Contractor on the next normal working day.

§ 12.2.5 The Owner shall direct, if endeavors to contact the Contractor fail, certain telephone notification to Subcontractors in order to expedite emergency repairs. The Contractor shall not be relieved of responsibility by the procedure, and the Contractor shall supervise and direct correction of defects as required by the Contract Documents.

§12.2.6 The manufacturer of a product may be specifically mentioned as a party to a warranty. Then in such cases, it shall be the Contractor's obligation to produce the required warranty of the manufacturer and submit it to the Architect for examination and approval. Inclusion of a manufacturer as a party to a warranty does not relieve the Contractor from the requirements of the Contract Documents.

§12.2.7 Warranties on operating systems, equipment, or components placed in operation prior to Substantial Completion or acceptance shall begin on the date of Substantial Completion.

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition.

During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

(Paragraphs deleted)
§ 12.2.2.4 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.2.5 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.2.6 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the laws of the State of Maryland and shall be construed in accordance with such laws.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

§13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§13.3.2 All Contractor proposals, approvals, instruction, requests, claims, demands, and other notices shall be made in writing on Contractor's stationery; meeting minutes and FAX transmissions will not be considered written notice from Contractor.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

(Paragraph deleted)
§13.4.2 In any claim and/or litigation filed by the Owner against the Contractor to enforce any provision of this Contract, the Owner shall be entitled to all reasonable attorney's fees, expenses, damages, litigation expenses, and court costs incurred in and/or resulting from any such claim and/or litigation. In any claim and/or litigation brought by the Contractor against the Owner and/or its agents, the Contractor shall bear the Owner's court costs, expenses, and reasonable attorney's fees incurred, unless the Court specifically determines as a matter of fact and law that the Owner, knowingly, willfully, and intentionally breached a provision of this Contract giving rise to Contractor's claim and resulting damages

§ 13.4.3 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

§ 13.6.1 No interest shall be paid by the Owner to the Contractor.

§ 13.7 TIME LIMITS ON CLAIMS, COMMENCEMENT OF STATUTORY LIMITATION PERIOD

§ 13.7.1 Contractor recognized and agrees that Owner is a governmental agency and that the statute of limitations is not applicable to claims and/or litigation filed by the Owner. Limitations as to time for filing of any claims, disputes, and/or litigation by the Contractor, or any person or entity claiming by, through, or on behalf of the Contractor, shall be as specified in Article 15.

13.8 BUY AMERICAN STEEL

§13.8.1 Contractor shall comply with the Buy American Steel Act Sections 17–301 to 17-306 of the Finance and Procurement Article of the Annotated Code of Maryland.

§13.8.2 Contractor shall be required to use or supply the domestic steel products unless the cost is unreasonable or inconsistent with the public interest.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

(Paragraphs deleted)

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed.

(Paragraph deleted)

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contractor's employment under this Contract if the Contractor:

.1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents such as, but not limited to:

(1) Failure to maintain progress in accordance with project schedule;
(2) Prevents other Contractors from meeting their scheduled progress;
(3) Performs work in a negligent or defective manner or in a manner contrary to the Contractor Documents;
(4) Failure to provide and maintain the required insurance coverage and the required bonds;
(5) Filing of bankruptcy proceedings by or against the Contractor and/or the filing of an assignment for the benefit of Contractor's creditors; and/or
(6) Breach of any provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
.2 accept assignment of subcontracts pursuant to Section 5.4; and
.3 finish the Work by whatever reasonable method the Owner may deem expedient.

.4 When the Owner terminated the Contractor for one of the reasons stated in Subparagraph 14.2.1 and invokes the Performance Bond to complete the Work, the surety shall not without the written consent of the Owner, retain the Contractor for the Work, and the Contractor shall not without written consent of the Owner perform any of the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished. In the event the Owner elects to terminate the Contractor's employment under this Contract, the Contractor shall only be entitled to be paid for work under the Contract actually completed by the Contractor up to the date of Contractor's termination less deductions for

(1) the cost of correcting any deficient or defective work, including compensation for the Construction Manager and Architect and their respective consultants' additional services and expenses made necessary by the Contractor's defective work, default, neglect, or failure to perform under this Contract;

(2) damages incurred by the Owner as a result of the Contractor's breach, including but not limited to the costs to finish the work and damages for delay, if any, in completing the work under the Contract;

(3) actual reasonable attorney's fees incurred by the Owner in obtaining legal advice, counsel, and/or representation relating to the issues of Contractor's breach of contract, defective work, default, neglect, or failure to perform and Owner's legal options relating thereto as well as any other reasonable attorney's fees due to Owner under other provisions of this Contract; and

(4) such other amounts due and owing to Owner under the terms and conditions of the Contract documents. In the event the Contractor is terminated pursuant to Article 14.2. the Contractor shall not be entitled to any remaining funds under the Contract, except as specifically provided above and subject to the availability of funds after all work is completed.

All remaining unpaid funds in the Contract as of the date of Contractor's termination shall be the sole and exclusive property of the Owner, and the Contractor shall be paid by the Owner at the conclusion of all work under the Contract as provided above, but only to the extent that there are funds remaining after all payments have been made first to complete the work under the Contract and to compensate the Owner as provided above in the(4) enumerated deductions in this Article 14.2.3. Any funds still remaining after payment for all work and after payment of the Contractor as provided above shall be the sole and exclusive property of the Owner.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and payment of the four (4) enumerated deductions in Article 14.2.3 other damages incurred by the Owner and not expressly waived, such excess shall be the sole and exclusive property of the Owner.. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor if any, for work completed by the Contractor 9less the deductibles provided in Paragraph 14.2.3) shall be determined by the Owner, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

(Paragraphs deleted)

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor (and any person or entity claiming by, through, or on behalf of Contractor) arising out of or relating to the Contract. Claims must be initiated by written notice, on Contractor's stationary. Meeting minutes and Fax transmissions from the Contractor will not be considered written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Decision of Architect. Any claim, dispute, or other matter in question between the Contractor and the Owner shall be made in writing to the Architect except those relating to artistic effect as provided in Subparagraph 4.2.13 and those which have been waived by the making or acceptance of final payment as provided in Article 9. The Architect shall provide each party with ample opportunity to present its evidence with respect to the claim made, and the Architect shall render his decision on the claim not less than ten (10) days after the close of evidence before the Architect. The decision of the Architect may be appealed by litigation in the Circuit Court of Howard County as provided below. However, no litigation of any such claim, dispute or other matter may be made until the earlier of (1) the date on which the Architect has rendered a written decision, or (2) the eleventh day after the parties have presented their evidence to the Architect or have been given a reasonable opportunity to do so, if the Architect has not rendered a written decision by that date. With respect to all claims and/or disputes, the final written decision of the Architect shall be final and binding on the parties and on those claiming by, through, and/or on behalf of any such party, person, or entity who had the right to do so, and failed to do so, unless the final written decision of the Architect as to any such claim and/or dispute is appealed to the Circuit Court for Howard County by a party within thirty (30) days after having received the Architect's final written decision. In any such appeal of the Architect's final written decision , it shall be presumed that the Architect's decision is correct, and the Architect's decision shall be treated and regarded in the same manner in which an arbitrator's award would be treated and regarded by a Maryland court under Maryland's Uniform Arbitration Act, subject, however, to the procedural requirements specified in the Contract documents. The failure to appeal the Architect's final written decision within the aforementioned thirty (30) day period shall result in the said decision becoming final and binding on all parties as provided above. The Circuit Court for Howard County, Maryland, shall be the sole and exclusive jurisdiction for appealing any final written decision of the Architect. If the Architect renders a decision after litigation proceedings have been filed, such decision may be entered as evidence but will not supersede any litigation proceedings unless the decision is acceptable to all parties concerned.

§ 15.1.3 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

§ 15.1.4 Continuing Contract Performance. Pending final resolution of a Claim except as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. Except the Owner may withhold payment to the extent reasonably necessary to secure or compensate for a claim. This Article 15.1.4 shall not apply if the Owner has terminated the Contractor's employment pursuant to

.§ 15.1.5 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

(Paragraphs deleted)
§ 15.1.6
(Paragraphs deleted)
Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4

§ 15.1.7 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 15.1

§ 15.1.8 Claims for Additional Time

§ 15.1.8.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice shall be made in writing to the Architect not more than twenty-one (21) days after the commencement of the delay, otherwise it shall be waived.

§ 15.1.8.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction. . In establishing the time of construction completion, the weather conditions as recorded by the National Oceanic Atmospheric Administration (NOAA) at the National Climatic Data Center, Ashville, North Carolina over the past five (5) years will be taken into consideration. No extension of time, due to weather conditions, will be considered unless accompanied by NOAA documentary evidence showing by comparison that such weather is abnormal to the statistical mean of the past five (5) years and that such abnormality caused the delay.

§ 15.1.8.3 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible,

written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 15.2 RESOLUTION OF CLAIMS AND DISPUTES

§ 15.2.1 Litigation

§ 15.2.1 Any Claim arising out of or related to the Contract. Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be resolved finally by litigation in the Circuit Court of Howard County, Maryland, provided, however, that the provisions of this Article 15.2.1 authorizing litigation in court shall not be exercised by any party until the provisions of Article 15.1.2 shall have been complied with and exhausted. No party shall be entitled to litigate any dispute and/or claim unless and until that party has fully complied with the provisions of Article 15.1.1 The failure of any party to adhere to and comply with the provisions of Article 15.1.1 shall serve as a bar to that party's litigating a claim and/or dispute in court.
§ 15.2.2 Claims and Timely Assertion of Claims. Since the Owner is a public body, politic and corporate, its claims shall not be barred by any contractual period of limitations or by any statute of limitations. Claims by the Contractor shall be filed as provided in Article 15 (Claims and Disputes), and the time limits prescribed in Article 15 shall serve as a limitation upon filing of any and all claims and/or litigation by the Contractor and/or any person or entity claiming by, through, or on behalf of the C§15.2 Policies of Employment.

15.3 Policies of Employment.

(Paragraphs deleted)
§15.3.1 The Contractor shall maintain policies on employment as follows:

1. The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, sex, national origin, or age. Such action shall include but not be limited to the following:

   Employment, upgrading demotion or transfer, recruitment or recruitment advertising layoff or termination rates or pay or other forms of compensation and selection for training including apprenticeship.

   The Contractor shall post in conspicuous places available to employees and applicants for employment notices setting forth the policies of non-discrimination.

§15.3.2 The Contractor and all Subcontractors shall in all solicitations or advertisements for employees placed by them or on their behalf state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

§15.3.3 Minority Business Enterprise (MBE) Requirements are a part of the Conditions of the Contract, including Exhibits A, B, and C included with Form of Proposal.

ARTICLE 16 CONTRACTOR PERFORMANCE EVALUATION SCORECARD

Upon completion of a project or at any time during the project, the awarded contractor shall receive a performance evaluation scorecard rating the contractor's performance on the project. The evaluation scorecard will become part of the contractor's permanent file. A sample Contractor Performance/Evaluation Scorecard is included with the bid documents.

The evaluation scorecard shall include the following performance indicators; Quality of Work, Responsiveness, Professionalism, Resources, Schedule Management, Quality Control, Deficiency Resolution, Submittal Management, Training, Appearance, Security, Safety, Utility Conservation, Disruptions, Quality of Materials, Emergency

Response, Hazardous Materials, Innovation, Teamwork, Cost Management, Billing, Compliance.

A contractor shall have up to 3 weeks after notification to appeal, challenge or otherwise dispute the scorecard results. After the 3-week period, the scorecard shall be considered final and accepted by the contractor.

A contractor receiving a 70% or less overall evaluation scorecard rating for a project may be disqualified for bidding on any future projects with the HCPSS for a period of three (3) years and/or for the remaining contract term including renewal options.

EXHIBIT A

1. Commercial General Liability

Insurer (precise name as per policy, not group name)				
Best's Rating and Financial Size				
Each Occurrence Limit				
Personal and Advertising Injury Limit				
General Aggregate Limit				
Products/Completed Operations Aggregate Limit				
Occurrence Basis	yes		no	
General Aggregate Limit applies Per Project	yes		no	
Premises/Operations	yes		no	
Actions of Independent Contractors	yes		no	
Products/Completed Operations	yes		no	
Contractual Liability	yes		no	
Explosion, Collapse or Underground (XCU) Hazards	yes		no	
Owner included as an additional insured		yes		no
Individuals related to Owner included as additional insureds	yes		no	
Manuscript additional insured wording per insurance requirements	yes		no	
If no, additional insured coverage extends to cover liability arising out of:				
Owner's general supervision	yes		no	
Products and completed operations	yes		no	
Specimen of additional insured wording attached if other than manuscript wording in the insurance requirements	yes		no	
No cross suits or cross liability exclusion	yes		no	
Coverage for additional insureds is primary to Owner's coverage	yes		no	
60 days notice of cancellation, nonrenewal, etc.	yes		no	
Amount of Retention or Deductible				
Specify if Retention or Deductible applies per occurrence or claim				

2. Business Auto Liability

Insurer (precise name as per policy, not group name)		
Best's Rating and Financial Size		
Each Accident Limit		
Any Auto (or Hired and Non-owned Autos, if no owned autos)	yes	no

Contractual Liability yes no
60 days notice of cancellation, nonrenewal, etc. yes no
Amount of Retention or Deductible
Specify if Retention or Deductible applies per accident or claim

3. Workers Compensation and Employers Liability

Insurer (precise name as per policy, not group name)
Best's Rating and Financial Size
Statutory benefits as required by state or Federal law yes no
"Other States" coverage yes no
Employers liability yes no
Each accident limit
Each employee limit-disease
Policy limit-disease
60 days notice of cancellation, etc. yes no
Amount of Retention or Deductible
Specify if Retention or Deductible applies per accident or claim

4. Contractors Pollution Liability

Insurer (precise name as per policy, not group name)
Best's Rating and Financial Size

Each Pollution Incident Limit
Annual Aggregate Limit
Other Limit(s)

Coverage Form: Claims Made Occurrence
Covers Operations of Both Contractor and Subcontractors yes no
Contractual Liability yes no

60 days notice of cancellation, nonrenewal, etc. yes no
Amount of Retention or Deductible
Specify if Retention or Deductible applies per occurrence or claim

5. Umbrella Excess or Excess Liability

Insurer (precise name as per policy, not group name)
Best's Rating and Financial Size
Coverage Form: Umbrella and Excess Straight Excess

Each Occurrence Limit
General Aggregate Limit (for other than products/completed operations and auto liability)
Products/Completed Operations Aggregate Limit

Underlying Schedule of Insurance includes:
Commercial General Liability yes no
Business Auto Liability yes no
Employers Liability yes no

Owner included as an additional insured	yes	no
Individuals related to Owner included as additional insureds	yes	no
Manuscript additional insured wording per insurance requirements	yes	no
If no, additional insured coverage extends to cover liability arising out of:		
Owner's general supervision	yes	no
Products and completed operations	yes	no
Specimen of additional insured wording attached if other than manuscript wording in the insurance requirements	yes	no
No cross suits or cross liability exclusion	yes	no
Coverage for additional insureds is primary to Owner's coverage	yes	no
60 days notice of cancellation, nonrenewal, etc.	yes	no
Amount of Retention		
Retention applies per occurrence	yes	no

INSURANCE AGENT'S OR INSURER'S STATEMENT

I have reviewed the Contract's insurance requirements with the contractor named below. I hereby verify the above responses.

Name of Agent or Insurer:

Agency or Insurer Name:

Authorized Signature and Date:

Phone #: Fax #: E-mail:

CONTRACTOR'S STATEMENT

If awarded the contract, I will comply with the Contract's insurance requirements. I further agree to maintain property insurance on the machinery, tools and equipment which are owned, rented or leased by my firm and which are utilized in the performance of the services rendered under this Contract.

Contractor's Name:

Authorized Signature and Date:

Phone #: Fax #: E-mail:

EXHIBIT A
CHANGE ORDER REQUEST FORMAT

PROJECT NAME:_____ DATE:_____

GENERAL CONTRACTOR:_____

SUBCONTRACTOR:_____

SUB-SUBCONTRACTOR:_____

C.O.R. ITEM OR WORK:_____

I. DIRECT PAYROLL LESS FRINGES, INSURANCE, TAXES*:_____

II. FRINGES, TAX, INSURANCE BURDEN____% OF PAYROLL:_____

III. TOTAL MATERIAL COSTS**: _____

IV. MATERIAL SALES TAX: _____

V. EQUIPMENT RENTALS (ATTACH COPY OF INVOICE): _____

VI. CONTRACTOR-OWNED EQUIPMENT**: _____

VII. PROFIT AND OVERHEARD 20% OF LINES I & III: _____

VIII. 8% OF LINE V (ONLY WITH INVOICE COPY): _____

IX. TOTAL ALL LINES: _____

X. SUBCONTRACTORS COSTS (ATTACH BREAKDOWN): _____

XI. 8% PROFIT & OVERHEAD ON SUBCONTRACTORS: _____

XII. TOTAL LINES IX, X, & XI: _____

XIII. BOND ____% OF LINE XII: _____

XIV. TOTAL COST OF WORK: _____

*Provide Itemization of Labor Hours and Worker Classification
**Provide Itemization.

Change Order Request Format is Required for each Portion of Change Order Request Submission.

EXHIBIT A

DESCRIPTION

All change orders shall be submitted in the change order request format (see Exhibit A) as set forth below:

1. Attach an itemization of labor hours. A certified payroll affidavit may be required to substantiate labor rates. The cost of foreman and superintendents may be added only when the change order makes necessary the hiring of additional supervisory personnel or makes their employment for time in addition to that required by the basic contract.

2. Labor burden percentage costs shall include all fringes, taxes, insurance, liabilities, workmen's compensation, unemployment, and any additional cost associated as labor burdens. Labor burden percentage rates are subject to approval of the Owner and is not subject to profit and overhead.

3. Attach an itemization of all materials used listing unit prices and extended prices.

4. Attach an itemization of equipment used and rental rates. If equipment is a rental, attach copy of the rental invoice. Rental equipment and contractor-owned equipment costs shall include all costs associated with the equipment, i.e. transportation, set-up, gas, and oil. Rental rates shall not exceed rates established by local rental companies and "MEANS DATA" rates.

5. Profit and overhead shall be considered full reimbursement for any additional expenses caused by the change order work. The Contractor shall agree to 20% profit and overhead markup on work by his own forces and 8% profit and overhead mark up on Subcontractors work. Allowances for overhead shall include but not limited to the costs for use of, small tools and consumables; trucks and trucking costs; maintenance and/or operations of Contractor's regular established office, branch office, and other facilities; resident and/or non-actively engaged supervision; time keepers; clerk; stenographer; watchmen; cost of correspondence; increased item of warranty under the change.

6. Profit and overhead at 8% may be added to equipment which is rented.

7. Only the actual added costs of the bond may be added to the change order amount. No further markup shall be allowed.

8. Change order requests shall not be considered unless they are submitted in proper format with all required and requested supporting documentation. All portions of the change shall use the change order request format.

9. For all work to be performed by a Subcontractor/Subcontractors, the Contractor shall furnish the Subcontractors itemized proposal which shall contain original signatures by an authorized representative of the Subcontracting firm. If requested by the Owner or Architect, proposals from suppliers or other supporting data to substantiate the Contractor's or Subcontractor's cost shall be furnished.

10. On changes resulting in a credit to the Owner, the credit shall be the net cost without profit overhead and profit.

11. Change order costs shall not exceed unit pricing as provided if applicable by Contract Documents.

Howard County Public School System

Office of Purchasing
10910 Clarksville Pike, Ellicott City, Maryland 21042-6198
(410) 313-6644, fax (410) 313-6789

Terms and Conditions

1.1 CONTRACT AWARD

It is the intent of The Board of Education of Howard County on behalf of the Howard County Public School System (hereinafter "HCPSS" or the "Board") to award to the lowest responsive and responsible Bidder(s) meeting specifications. HCPSS retains the right to award in aggregate, item-by-item, group-by-group, in full or in part, make multiple awards, partial awards, to increase or decrease quantities where quantities are shown and may reject any bid which indicates any omission, contains alteration of form or additions, or imposes conditions, or offers alternate items and may make any award which is deemed in the best interest of the HCPSS or to make no award at all at its sole discretion.

The HCPSS shall be the sole authority as to whether Bidder's offer meets specifications or are an approved equal and further reserves the right to reject any or all proposals or waive any informality which may appear to be in its best interest. HCPSS further reserves the right to consider information other than price when evaluating bids. A contract may be awarded to the provider(s) whose proposal best meets HCPSS requirements and needs at the time of award and whose fee structure is in the best interest of HCPSS.

HCPSS reserves the right to make an award with or without negotiations or to request best and final offers or to make award with or without further review.

In the event of tie bids where all factors are equal, award shall be made to one of the tie bidders in the following order of preference: Howard County based Bidder, the out of county Bidder but incorporated in Maryland, and then the out of state based Bidder In the event a tie bid still exists, the Director of Procurement and Materials Management or their designee, shall conduct a coin toss for selection of the potential Award Bidder(s) or seek a geographical, proportional or divided award of contract, whichever is in the best interest of HCPSS.

1.2 CONTRACT DOCUMENTS

Contract Documents consist of all solicitation documents, the specifications and scope of work and any applicable addenda, and any additional documentation issued. All of these materials and documents associated with this solicitation will be included in the Contract(s) which the Board of Education awards as a result of this solicitation and will become the contract. The offeror, by submitting its proposal, agrees that if awarded the contract that it will be bound under the contract to all the Terms and Conditions of the Contract Documents for any future goods and/or services awarded under this contract.

If Offeror's proposal is accepted and awarded, it will become incorporated and an integral part of the contract. However, Bidder's terms and conditions and any exceptions to HCPSS terms and conditions, unless expressly accepted by HCPSS, shall be excluded from the contract documents.

1.3 ORDER OF PRECEDENCE

In the event of an inconsistency among provisions of this Request for Proposal, the inconsistency shall be resolved by the following order of precedence:

2.3.1 Section III: Specifications
2.3.2 Section II: Terms and Conditions
2.3.3 Section I: General Information
2.3.4 Appendices

1.4 WAIVER OF RIGHT TO BID ON OTHER CONTRACTS

The Offeror agrees that it and its parent, its affiliates and subsidiaries, if any, waive the right to bid on any procurement contracts, of any tier, resulting from the goods and/or services to be provided under this agreement.

1.5 INITIATION OF WORK

The Offeror shall not commence performance of the services until it receives a formal written notice to proceed from HCPSS.

1.6 BILLING AND PAYMENT

The awarded Contractor shall submit invoices to the Howard County Public School System, (Name of Department), 10910 Clarksville Pike, Ellicott City, MD 21042, Attn: (Name of Contact), at the completion of each job. To expedite payments, invoices must contain the following information:

a) Purchase Order Number

b) Name of school or office

c) Description of work along with quantities

d) Start date and completion date

e) Itemized breakdown of project costs to include labor and materials.

f) Total due

Invoices that do not contain the above information may be rejected.

Timely invoicing is required. Awarded Bidder(s) must submit invoices for services and/or goods no later than sixty (60) days following services rendered or receipt of goods. Awarded Bidder(s) expressly waives its right to payment if invoices are not submitted by the end of each fiscal school year (June 30th) or within sixty (60) days following services rendered, receipt of goods, or completion of project milestones, whichever is later, however, not to exceed 365 calendar days.

1.7 INSURANCE

The Offeror has in force, or shall obtain, and will maintain insurance for the full term of the contract (including any executed renewals) in not less than the amounts specified and accordance with the requirements contained in APPENDIX H, INSURANCE REQUIREMENTS.

1.8 SUBCONTRACTING OR ASSIGNMENT

It is mutually understood and agreed that Awarded Bidder(s) shall not assign, transfer, convey, sublet, or otherwise dispose of their contract or their rights, title or interest, therein, or their power to execute such contract in whole or in part to any other person, firm, or corporation, without the previous written consent of the HCPSS' Purchasing Director, but in no case shall such consent relieve the contractor from their obligation, or change the terms of the contract or purchase order.

Assignment or subcontracting without the written approval of HCPSS will be cause for termination.

In the event that some or all of the services and/or goods under this solicitation are permitted to be subcontracted, the bidder shall identify all proposed subcontractor/sub-consultant who will be furnishing services and/or under the terms of this solicitation. Subcontractor/sub-consultants shall conform in all respects to the applicable provisions specified for the prime contractor and shall be subject to approval by HCPSS. If a subcontractor/sub-consultant is determined to be unacceptable by HCPSS, the contractor shall substitute an acceptable subcontractor/sub-consultant with no change in any contract unit prices or overall contract sum. If a firm fails, within a timely manner, to propose another subcontractor/sub-consultant to which HCPSS has no objection, HCPSS reserves the right to reject the proposal. The bidder will use only those subcontractor/sub-consultants approved by HCPSS. All subcontractor/sub-consultants shall comply with all federal and state laws and regulation which are applicable to the services covered by the subcontractor and shall include all terms and conditions set forth herein which apply with equal force to the subcontractor/sub-consultant, as if they were the contractor referred to herein. The Awarded Bidder(s) is responsible for the contract performance, whether or not subcontractor/sub-consultants are used.

1.9 CHANGES, ALTERATIONS OR MODIFICATIONS IN THE SERVICES

HCPSS shall have the right, at their discretion, to change, alter, or modify the services provided for in this agreement and such changes, alterations, or modifications may be made even though it will result in an increase or decrease in the services of the Awarded Bidder(s) or in the contract cost thereof.

If such changes cause an increase or decrease in the Awarded Bidder's cost of, or time required for, performance of any service under this contract, whether or not changed by an order or amendment, an equitable adjustment shall be made and the contract shall be modified in writing accordingly. Any claim of the Awarded Bidder(s) for adjustment under this clause must be asserted in writing within thirty (30) days from the date of receipt by the Awarded Bidder(s) of the notification of change unless the project manager or his duly authorized representative grants a further period of time before the date of final payment under the contract.

No services for which an additional cost or fee will be charged by the Awarded Bidder(s) shall be furnished without prior written authorization of HCPSS.

1.10 DELAYS AND EXTENSIONS OF TIME

The Awarded Bidder(s) shall execute the work continuously and diligently and no charges or claims for damages shall be made by the Awarded Bidder(s) for any delays, acceleration, or hindrance, from any cause whatsoever, during the progress of any portion of the services specified in the contract documents. Any and all time extensions and/or changes/substitutions of products, materials, equipment, and/or supplies must be requested in writing by the Awarded Bidder(s) before the extension and/or change takes place, and must be approved in writing by HCPSS. Such delays, acceleration, or hindrances, if any, may be compensated for by an extension of time for such reasonable period as HCPSS may decide. Time extensions may be granted only for excusable delays such as delays beyond the control and without the fault or negligence of the awarded bidder(s).

1.11 PRICE ADJUSTMENTS

HCPSS will only consider adjustments on labor rates based only upon federal minimum wage increases and decreases in the Consumer Price Index (CPI-W), Baltimore Region, as published by the Bureau of Labor Standards. Requested increases above a 5% cap will not be considered. In order to receive consideration for a price increase, the Contractor must submit to The Howard County Public School System, sixty (60) days prior to the contract expiration date, a statement of any change in the hourly rate wage actually to be paid to its employees during the renewal term.
Adjustments will be calculated by comparing the current index with the previous year's index so as to determine the change in index points. The point change will then be divided by the price index to obtain the percentage of change. The percentage of change will then be multiplied by .75 to obtain the adjustment to be applied to the current prices.

The HCPSS will also consider adjustments based on fees outside of the control of the Contractor, such as manufacturer price increases. However, such increases will be a "pass through" to the Howard County Public School System with no markup allowed. For such changes to be considered by the Howard County Public School System, documentation from the manufacturer (or any other applicable party) assessing a cost increase must accompany a written request from the Contractor. The Howard County Public School System will then review the request and advise the Contractor of approval or disapproval of the price change request. Price increase requests will not be considered if not accompanied with the proper information.

1.12 REMEDIES AND TERMINATION

a. **Correction of Errors, Defects, and Omissions** - The Awarded Bidder(s) agrees to perform work as may be necessary to correct errors, defects, and omissions in the services required under the contract documents without undue delays and without cost to HCPSS. The acceptance of the work set forth herein by HCPSS shall not relieve the Awarded Bidder(s) of this responsibility.

b. **Set-Off** - HCPSS may deduct from and set-off against any amounts due and payable to the awarded bidder(s) any back-charges or damages sustained by HCPSS by virtue of any breach of this agreement by the awarded bidder(s) to perform the services or any part of the services in a satisfactory manner. Nothing herein shall be construed to relieve the Awarded Bidder(s) of liability

for additional construction and design or other costs, expenses, and damages resulting from a failure to satisfactorily perform the services. Nothing herein shall limit the liability of the Awarded Bidder(s) for damages and HCPSS may affirmatively collect damages from the awarded bidder(s).

c. **Termination for Cause** - If the Awarded Bidder(s) fails to fulfill its obligations under this contract properly and on time, otherwise violates any provision of the contract, HCPSS may terminate the contract by providing thirty (30) days' written notice to the Awarded Bidder(s). The notice shall specify the acts of omissions relied on as cause for termination. All finished or unfinished supplies and services provided by the Awarded Bidder(s), shall at HCPSS's option, become HCPSS property. HCPSS shall pay fair and equitable compensation for satisfactory performance of services or goods delivered prior to the receipt of notice of termination, less the amount of damages caused by Awarded Bidder's breach.

If the damages are more than the compensation payable to the Awarded Bidder(s), the Awarded Bidder(s) will remain liable after termination and HCPSS can affirmatively collect damages.

d. **Termination for Convenience** - HCPSS may terminate all or any part of the work required under this contract for the convenience of HCPSS by providing ninety (90) days' written notice. In the event of such termination, HCPSS shall determine the costs the Awarded Bidder has incurred to the date of termination. The Awarded Bidder(s) shall not be reimbursed for any anticipatory profits which have not been earned up to the date of termination. The Awarded Bidder(s) agrees that the Awarded Bidder(s) does not have the right to termination for convenience.

e. **Termination for Non-Appropriation of Funds:** HCPSS may terminate this contract, in whole or in part, due to insufficient funding with thirty (30) days' written notice to the awarded bidder(s). HCPSS shall pay for all of the purchases and services, if any, incurred up to the date of the termination notice.

f. **Obligations of Awarded Bidder(s) upon Termination** - Upon notice of termination as provided above, the Awarded Bidder(s) shall:

a) Take immediate action to orderly discontinue its work and demobilize its work force to minimize the occurrence of costs.

b) Take such action as may be necessary to protect the property of HCPSS, place no further orders or subcontract, and assign to HCPSS in the manner and to the extent directed by HCPSS all of the right, title and if ordered by HCPSS, possession and interest of Awarded Bidder(s) under the orders or subcontracts terminated.

c) Deliver to HCPSS all materials, equipment, data, drawings, specifications, reports, estimates, and such other information accumulated by the Awarded Bidder(s) which has been or will be reimbursed under this agreement after taking into account any damages that may be payable to HCPSS. Title to such items shall be transferred to HCPSS.

g. **Remedies Not Exclusive -** The rights and remedies contained in this general condition are in addition to any other right or remedy provided by law, and the exercise of any of them is not a waiver of any other right or remedy provided by law.

1.13 RESPONSIBILITIES AND WARRANTIES

a. The Awarded Bidder(s) (also referred to herein as "Contractor") shall perform the services and/or provide the goods with that standard of care, skill, and diligence normally provided by a Contractor, or professional in the performance of services and/or goods similar to the services and/or goods hereunder.

b. Notwithstanding any review, approval, acceptance, or payment for the services by HCPSS, the Contractor shall be responsible for professional and technical accuracy of its work furnished by the Contractor under this agreement.

c. HCPSS's review, approval, or acceptance of, nor payment for, any of the services required under this contract shall NOT be construed to operate as a waiver of any rights under this contract or of any

cause of action arising out of the performance of this contract, and the Contractor shall be and remain liable to HCPSS in accordance with applicable law for all damages to HCPSS caused by the Contractor's negligent performance of any or the services furnished under this contract.

d. Contractor warrants that it is qualified to do business in the State of Maryland and that it will take such action as, from time-to-time hereafter, may be necessary to remain so qualified.

e. Contractor warrants that it is not in arrears with respect to the payment of any monies due and owing the county or state, of any department or agency thereof, including but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this agreement.

f. Contractor warrants that it shall comply with all federal, state, and local law, ordinances and legally enforceable rules and regulations applicable to its activities and obligations under this agreement.

g. Contractor warrants that it shall procure, at its expense, all licenses, permits, insurance, and governmental approval, if any, necessary to the performance of its obligations under this agreement.

h. Contractor agrees that the equipment or supplies furnished under this award and or contract shall be covered by the most favorable commercial warranties the Contractor gives to any customer for such equipment or supplies and that the right and remedies provided herein are in addition to and do not limit any rights afforded to the HCPSS by any other clauses of the contract. All equipment shall in the very least carry a standard factory warranty against defects in parts and workmanship for the time period stated in the product warranty specifications and/or for one (1) year from date of acceptance. If the manufacturer warrants equipment for a period longer than one (1) year, the Contractor shall pass through this time to HCPSS.

i. Contractor warrants that the facts and matters set forth hereafter in the "Contract Affidavit" which is attached to this agreement and made a part hereof are true and correct.

1.14 PROTESTS AND DISPUTES

Except as otherwise provided in these contractual documents, any claim, dispute, or other matter in question concerning a question of fact shall initially be referred to the Procurement Specialist.

Any claim, dispute, or other matter in question concerning a question of fact referred to the Project Manager that is not disposed of by agreement shall be referred to the Director of Procurement and Materials Management, HCPSS, who shall reduce his decision to writing and mail or otherwise furnish a copy to the Contractor. The decision of HCPSS shall be final and conclusive.

1.15 GOVERNING LAW AND VENUE

The Contract Documents shall be governed by the laws of the State of Maryland and nothing in these Contract Documents shall be interpreted to preclude HCPSS from seeking, after completion or termination of the agreement, any and all remedies provided by law. Any lawsuit arising out of the Contract Documents shall be filed in the appropriate state court of competent jurisdiction located in Howard County, Maryland.

1.16 WAIVER OF JURY TRIAL

The Awarded Bidder(s) and the Board hereby waive trial by jury in any action or proceeding to which the Board and/or Awarded Bidder(s) are parties arising out of or in any way pertaining to the Contract Documents. It is agreed and understood that this waiver constitutes a waiver of trial by jury of all claims against all parties to such actions or proceedings, including claims against parties who are not parties to the Contract Documents. This waiver is knowingly, willingly and voluntarily made by the Board and the Awarded Bidder(s) and the Awarded Bidder(s) hereby represent and warrant that no representations of fact or opinion have been made by and individual to induce this waiver of trial by jury or to in any way modify or nullify its effect. The parties further represent and warrant that they have been represented or have had the opportunity to be represented, in the signing of the Contract Documents and in the making of this waiver by legal counsel, selected of their own free will, and that they have had the opportunity to

discuss this waiver with legal counsel.

1.17 EXAMINATION OF RECORDS

The Contractor agrees that the auditor of HCPSS or any of their duly authorized representatives shall, have five (5) years after the final renewal expiration date under this contract, have access to and the right to examine any directly pertinent books, documents, papers, and records of the Contractor involving transactions related to this contract.

1.18 DISSEMINATION OF INFORMATION

During the term of this agreement, the Contractor shall not release any information related to the services or performance of the services under this agreement nor publish any final reports or documents without the prior written approval of the HCPSS contract manager.

1.19 COOPERATIVE PURCHASING CLAUSE

In accordance with State Finance and Procurement Article, Sect. 13-110, Maryland Annotated Code, HCPSS reserves the right to extend the terms of any contract resulting from this proposal to public bodies, subdivisions, school districts, community colleges, colleges, and universities including nonpublic schools. The Contractor agrees to notify HCPSS of those entities that request to use any contract resulting from this proposal and provide usage information to HCPSS, if requested.

Howard County Public School System assumes no authority, liability, or obligation, on behalf of any other public or non-public entity that may enter into a cooperative agreement associated with the contract resulting from this proposal. All purchases and payment transactions will be made directly between the contractor and the requesting entity.

1.20 NON-HIRING OF OFFICIALS AND EMPLOYEES

No official or employee of HCPSS whose duties as such official or employee include matters relating to or affecting the subject matter of this contract, shall during the pendency and term of this contract and while serving as an official or employee of HCPSS become or be an employee of the contractor or any entity that is a subcontractor on this contract.

1.21 ACCESS TO PUBLIC RECORDS ACT NOTICE

a. The Board of Education of Howard County is subject to the Maryland Public Information Act, State Government Article § 10-611, et. seq. As a result, the Board may be required to disclose, upon request, certain public records.
b. All information submitted as part of this proposal is subject to release under the Maryland Public Information Act (MPIA). If you would like the Howard County Public School System to consider redactions in the event that your proposal is subject to a MPIA request, submit a proposed MPIA copy including justifications for each redaction and under what specific exemption that justification is qualified for redaction.
c. Transparency in the use of public funding is fundamental to HCPSS operations. Prior to the award of bids and contracts, the Board of Education of Howard County reviews and approves cost to be incurred by the school system – therefore, offerors should be aware that submission to this RFP may subject your pricing offer to release in a public forum. Additionally, pricing and payments made by HCPSS under the resulting Contract may also become subject to release as public information. HCPSS may consider both the ability to obtain necessary pricing from future offerors as well as the potential to cause harm to the competitive position of offerors in determining release of pricing detail.
d. Copyrighted submittals are unacceptable and will be disqualified as non-responsive. All submittals become the property of HCPSS.

1.22 CONTINGENT FEE PROHIBITION

The Contractor warrants that they have not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Contractor, to solicit or secure this agreement, and that they have not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or any other consideration contingent on the making of this agreement.

For breach or violation of this warranty, HCPSS shall have the right to terminate this agreement without

liability, or, at its discretion, to deduct from the contract price or consideration, or percentage, brokerage fee, gift or contingent fee.

1.23 OWNERSHIP AND USE

All materials, including but not limited to training documents, program and software, diagnostic equipment and energy information systems furnished by Offeror to HCPSS in connection to this Program shall remain the property of the School System. No materials will be returned to the Contractor at the end of the contract period including any that are copyrighted. HCPSS shall have the right to continue using all and any control equipment and document materials for as long as the School System desires to do so.

All documents, materials or data developed as a result of this contract shall be the property of HCPSS. Therefore HCPSS has the right to use and reproduce any documents, materials, and data, including confidential information, used in or developed as a result of this contract. HCPSS may use this information for its own purposes, or use it for reporting to state or federal agencies. The awarded bidder(s) must keep confidential and warrants that it has title to or right of use of all documents, material, or data used or developed in connection with this contract.

1.24 ADHERENCE TO SCHOOL SYSTEM POLICIES AND STATE AND FEDERAL REGULATIONS

The Offeror and any Sub-Offeror personnel assigned to this project must be cognizant and abide by the Board of Education of Howard County Policies and operating procedures at all times. Health and safety policies and procedures will not be compromised. Proposed programs must not violate or conflict with the Board policies and Implementation Procedures. Moreover, the Contractor shall be cognizant and enforce all federal and state regulations and policies and all proposals and subsequent work shall adhere to known regulations and policies.

1.25 SEX OFFENDER NOTIFICATION

Maryland law requires certain sex offenders to register with the local law enforcement agency; See *Maryland Annotated Code*, Criminal Procedure Article, §11-704. One of the purposes of this law is to inform school systems when a Registered Sex Offender is residing or working in the area. When the sex offender registers, the local police are required to notify the Superintendent of Schools, and the Superintendent, in turn, is required to send a notice to school principals.

As a contractor/consultant working for HCPSS we require that you do not employ Registered Sex Offenders to work on projects for our school system if they, as a result, are required to perform delivery, installation, repair, construction or any other kind of services **on HCPSS property**. Further, Maryland Law requires that any person who enters into a contract with a county board of education "may not knowingly employ an individual to work at a school" if the individual is a registered sex offender; See §11-722 Criminal Procedure Article. An employer who violates this requirement is guilty of a misdemeanor and if convicted may be subject to up to five years imprisonment and/or a $5,000 fine.

Each contractor shall regularly screen their workforces to ensure that a Registered Sex Offender does not perform work at a county public school and also ensure that a subcontractor and independent contractor conducts screening of its personnel who may work at a school. The term "work force" is intended to refer to all of the contractor's direct employees and subcontractors and/or independent contractors it uses to perform the work. Violations of this provision may cause HCPSS to take action against the contractor up to and including immediate termination of the contract for cause.

Additionally, § 6-113 of the Education Article further requires that a contractor or subcontractor for a local school system may not knowingly assign an employee to work on school property with direct, unsupervised, and uncontrolled access to children, if the employee has been convicted of, or pled guilty or nolo contendere to, a crime involving a sexual offense, child sexual abuse and crimes of violence. The Contractor shall submit to HCPSS a listing of any employees assigned to perform under this agreement and certify that the necessary criminal history records checks have been conducted and that all assigned employees comply with the requirements.

1.26 CRIMINAL HISTORY BACKGROUND CHECKS

All employees, agents, or representatives of the Awarded Bidder(s) who will be performing work on any phase of the contract arising out of this Bid may be subject to a criminal history background check by

HCPSS. Such persons, if requested by the school system, must provide fingerprints and other required information in accordance with HCPSS requirements to facilitate such a check, as well as pay for the necessary fees to obtain such a check from the federal or state government. At the completion of a background check, the school system may, at its sole discretion, decide that a particular employee, agent, or representative of the Contractor be barred from school system property.

1.27 ETHICS

The Board of Education of Howard County has adopted an Ethics policy. Required by state statute, these Ethics regulations cover members of the Board of Education, the Superintendent, and all employees; and it specifies limits of participation of these individuals with entities doing business with The Howard County Public School System. For a copy of the regulations, please contact the Purchasing Office, Howard County Department of Education (410) 313-6644.

In accordance with Board Policy 2070-Ethics, offerors are hereby notified that the giving or offering of a gift or series of gifts to a Board official or employee is improper and may result in disqualification from future work on the grounds that the Offeror is no longer a responsible Offeror. All bidders are placed on notice that all questions/interpretations concerning the Board Ethics Policy may be submitted to the Ethics Review Panel.

1.28 DEBARMENT STATUS

By submitting their proposal, the offeror(s), certify that they are not currently debarred by the State of Maryland or another governmental entity from submitting bids or proposals on contracts for the type of products or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

1.29 TOBACCO FREE AND ALCOHOL/DRUG FREE ENVIRONMENT

The Board of Education of Howard County maintains a tobacco, alcohol/drug free environment. The sale or use of tobacco, alcohol or drugs, in any form, or related product, is prohibited in school buildings and grounds at all times. Persons found violating this policy will be requested to remove the product and themselves from school premises. Repeated use or sale of tobacco on HCPSS property, or any use or sale of alcohol, misuse of other drugs, or any use of illegal drugs by a contract employee while servicing this contract or while on HCPSS property will result in a prohibition of that employee from servicing the HCPSS contract. Repeated instances of violations by contract employees may result in termination of the contract for cause.

1.30 INDEMNIFICATION

The Awarded Bidder(s) shall be responsible for any loss, personal injury, expense, death and/or any other damage which may occur by reason of its acts, negligence, willfulness, or failure to perform any of its obligations under this agreement. Furthermore, any acts on the part of any agent, director, partner, servant or employee of the Awarded Bidder(s) are deemed to be the Awarded Bidder's acts.

Awarded Bidder agrees to indemnify and hold harmless the Howard County Public School System and its Board, employees, agents, representatives, and students from any claim, damage, liability, expense, and/or loss, including defense costs and attorney fees, arising directly or indirectly out of the Awarded Bidder's performance under the Contract Documents. The indemnification obligation of the Awarded Bidder shall include but shall not be limited to injuries to individuals and property of individuals who are not parties to the contract. In addition, the indemnification obligation of the Awarded Bidder shall cover the acts or omissions of any permitted subcontractors hired by the Awarded Bidder. Furthermore, the indemnification obligation of the Awarded Bidder shall survive termination of the contract for any reason.

1.31 PERMITS, CODES AND LAWS

All work shall be in accordance with all State, County, Federal, and Governmental rules, regulations, and laws. The contractor is responsible for assuring that all of their employee and services provided under the contract follow and comply with any such requirements pertaining and applicable to the service being provided under this contract. All costs to comply with these requirements shall be paid by the contractor and included in the contractors Bid price.

1.32 eMARYLAND MARKETPLACE ADVANTAGE REGISTRATION

Awarded bidders are required to register on eMaryland Marketplace Advantage at https://procurement.maryland.gov within five days following notice of award. Maryland law requires local and state agencies to post award notices on eMaryland Marketplace Advantage This cannot be done without the awarded bidder's self-registration in the system. Registration is free. Failure to comply with this requirement may be considered grounds for default. It is recommended that any interested bidder register with eMaryland Marketplace Advantage regardless of the award outcome for this procurement as it is a valuable resource for bid notification for municipalities throughout Maryland. If you have any questions or need assistance, contact the help desk at emma.helpdesk@maryland.gov or call (410) 767-1492.

1.33 RIGHT TO STOP WORK

If HCPSS determines, either directly or indirectly, that the Contractor's performance is not within the specifications, terms or conditions of this bid and/or that the quality of the job is unacceptable, HCPSS has the right to stop work. The stoppage of work shall continue until the default has been corrected and/or corrective steps have been taken to the satisfaction of HCPSS. HCPSS also reserves the right to e-bid this contract if it is decided that performance is not within the specifications as set out.

1.34 NON-DISCRIMINATION

In the execution of the obligations and responsibilities hereunder, included, but not limited to hiring or employment made possible by or relating to the Contract Documents, or the provisions of goods and services provided, the Awarded Bidder(s) shall not discriminate against persons on the basis **of** religion, ancestry or national origin, sex, age, marital status, sexual orientation, gender identity, disability, **or** genetic information**.** For more information, contact the Equity Assurance Office of the Howard County Public School System at 10910 Route 108, Ellicott City, ND 21042 or call 410-313-6654. HCPSS is fully committed to the Americans with Disabilities Act (ADA) which guarantees non-discrimination and equal access for persons with disabilities in employment, public accommodations, transportation, and all County programs, activities, and services. HCPSS government contractors, subcontractors, vendors, and/or suppliers are subject to this ADA policy. All individuals having any County contractual agreement must make the same commitment. Your acceptance of the awarded contract acknowledges your commitment and compliance with ADA.

1.35 INDEPENDENT CONTRACTOR

It is expressly understood and agreed that this Agreement is not intended and shall not be construed to create the relationship of agent, servant, employee, partner, joint venture, or association between the parties. The Awarded Bidder(s) will not be entitled to and expressly disclaims any right to worker's compensation, retirement, insurance, or other benefits afforded to employees of HCPSS.

1.36 CONTRACTOR PERFORMANCE/EVALUATION SCORECARD

Upon completion of a project/service or at any time during the project/service, the awarded contractor shall receive a performance evaluation scorecard rating the contractor's performance on the project/service, see Appendix G. The evaluation scorecard will become part of the contractor's permanent file. A sample Contractor Performance/Evaluation Scorecard is included with the bid documents.

The evaluation scorecard shall include the following performance indicators: Quality of Work, Responsiveness, Professionalism, Resources, Schedule Management, Quality Control, Deficiency Resolution, Submittal Management, Training, Appearance, Security, Safety, Utility Conservation, Disruptions, Quality of Materials, Emergency Response, Hazardous Materials, Innovation, Teamwork, Cost Management, Billing, Compliance. A contractor shall have up to 3 weeks after notification to appeal, challenge or otherwise dispute the scorecard results. After the 3-week period, the scorecard shall be considered final and accepted by the contractor.

A contractor receiving a 70% or less overall evaluation scorecard rating for a project/service may be disqualified for bidding on any future project/service with the HCPSS for a period of three (3) years and/or for the remaining contract term including renewal options.

1.37 ANTI-BRIBERY

Awarded bidder(s) warrants that neither it nor any of its officers, directors, or partners nor any of its employees who are directly involved in obtaining or performing contracts with any public body has been convicted of bribery, attempted bribery, or conspiracy to bribe under the laws of any state or of the federal government.

1.38 MULTIPLE PROPOSALS

No bidder will be allowed to offer more than one proposal for a solicitation regardless of the availability of several items or services that they feel may perform the same function or meet the specifications as described in the solicitation. If a bidder should submit more than one proposal for a solicitation, all solicitations may be rejected at the discretion of HCPSS.

CONTRACTOR PERFORMANCE/EVALUATION SCORECARD

Upon completion of a project or at any time during the project, the awarded contractor shall receive a performance evaluation scorecard rating the contractor's performance on the project. The evaluation scorecard will become part of the contractor's permanent file. A sample Contractor Performance/Evaluation Scorecard is included with the bid documents.

The evaluation scorecard shall include the following performance indicators; Quality of Work, Responsiveness, Professionalism, Resources, Schedule Management, Quality Control, Deficiency Resolution, Submittal Management, Training, Appearance, Security, Safety, Utility Conservation, Disruptions, Quality of Materials, Emergency Response, Hazardous Materials, Innovation, Teamwork, Cost Management, Billing, Compliance.

A contractor shall have up to 3 weeks after notification to appeal, challenge or otherwise dispute the scorecard results. After the 3-week period, the scorecard shall be considered final and accepted by the contractor.

A contractor receiving a 70% or less overall evaluation scorecard rating for a project may be disqualified for bidding on any future projects with the HCPSS for a period of three (3) years and/or for the remaining contract term including renewal options.

Name of Contractor: _____

Name of Project: _____ **Contract/Bid Number:** _____

Reviewed by: _____ **Department:** _____

Please take a moment to tell us about this contractor's performance. We will summarize all the information we obtain about each contractor and provide it to them. Supporting documentation shall be required to support any scores noted on the performance evaluation scorecard.

HOW SATISFIED. Please tell us **how satisfied** you are with the **performance** of the contractor named above. Circle a 10 if you are highly satisfied with their performance on a measure. Circle a 1 if you are highly dissatisfied with their performance on a measure. Circle a number in between to show different degrees of satisfaction. Circle **N/A** for any performance indicators that do not apply to the project. There are no right or wrong answers; just tell us how you feel.

A contractor receiving a 70% or less overall evaluation scorecard rating for a project may be disqualified for bidding on any future projects with the HCPSS for a period of three (3) years and/or for the remaining contract term including renewal options. The contractor shall be notified of their performance status after each project.

Satisfaction with the contractor's performance:	**Highly Dissatisfied**									**Highly Satisfied**	
1. **Quality of Work.** The contractor's ability to do the job right the first time.	1	2	3	4	5	6	7	8	9	10	N/A
2. **Responsiveness.** The contractor's ability to adapt to changes and meet unusual needs.	1	2	3	4	5	6	7	8	9	10	N/A
3. **Professionalism.** The courtesy and standards of conduct maintained by the contractor and his or her employees.	1	2	3	4	5	6	7	8	9	10	N/A
4. **Resources.** The contractor's ability to provide his or her employees with the tools, parts, and supplies needed to do the job.	1	2	3	4	5	6	7	8	9	10	N/A
5. **Schedule Management.** The contractor's ability to show up when scheduled and complete the work on time.	1	2	3	4	5	6	7	8	9	10	N/A
6. **Quality Control.** The contractor's ability to identify problems and deficiencies before you do.	1	2	3	4	5	6	7	8	9	10	N/A

CONTRACTOR PERFORMANCE/EVALUATION SCORECARD

7.	**Deficiency Resolution.** The contractor's ability to rapidly correct deficiencies in his or her work.	1	2	3	4	5	6	7	8	9	10	N/A
8.	**Submittal Management.** The contractor's ability to provide submittals In a timely and efficient manner.	1	2	3	4	5	6	7	8	9	10	N/A
9.	**Training.** The contractor's ability to provide employees well-trained in all aspects of their jobs.	1	2	3	4	5	6	7	8	9	10	N/A
10.	**Appearance.** The contractor's ability to keep uniforms, tools, and vehicles clean so as to portray a positive image.	1	2	3	4	5	6	7	8	9	10	N/A
11.	**Security.** The contractor's ability to safeguard your facilities and assets.	1	2	3	4	5	6	7	8	9	10	N/A
12.	**Safety.** The contractor's ability to keep the workplace safe and comply with OSHA requirements.	1	2	3	4	5	6	7	8	9	10	N/A
13.	**Utility Conservation.** The contractor's ability to use only the water, gas, electricity, and air conditioning needed to do the job.	1	2	3	4	5	6	7	8	9	10	N/A
14.	**Disruptions.** The contractor's ability to keep interruptions to the operations of your firm or agency to a minimum.	1	2	3	4	5	6	7	8	9	10	N/A
16.	**Quality of Materials.** The contractor's ability to use high quality parts and supplies.	1	2	3	4	5	6	7	8	9	10	N/A
17.	**Emergency Response.** The contractor's ability to rapidly restore normal operations after an emergency, power outage, or severe weather.	1	2	3	4	5	6	7	8	9	10	N/A
18.	**Hazardous Materials.** The contractor's ability to properly handle hazardous materials.	1	2	3	4	5	6	7	8	9	10	N/A
19.	**Innovation.** The contractor's ability to use new materials and adopt new methods to increase effectiveness.	1	2	3	4	5	6	7	8	9	10	N/A
20.	**Teamwork.** The contractor's ability to be a team player in order to assist in accomplishing the objectives of your firm or agency.	1	2	3	4	5	6	7	8	9	10	N/A
21.	**Cost Management.** The reasonableness of the contractor's costs, especially for contract changes.	1	2	3	4	5	6	7	8	9	10	N/A
22.	**Billing.** The contractor's ability to present correct and properly documented invoices.	1	2	3	4	5	6	7	8	9	10	N/A
23.	**Compliance**. The contractor complied with all rules, requests, regulations And requirements. This includes compliance with instructions Regarding interactions with students, staff and others.	1	2	3	4	5	6	7	8	9	10	N/A

CONTRACTOR PERFORMANCE/EVALUATION SCORECARD

Please summarize the contractor's overall performance based on the scores for the performance indicators noted above:

Please return the completed survey by email to: Kristal.Burgess@hcpss.org or fax (410) 313-6789

Thank you for your prompt assistance.

Title 29 - Labor

Subtitle A - Office of the Secretary of Labor

Part 5 - Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction (Also Labor Standards Provisions Applicable to Nonconstruction Contracts Subject to the Contract Work Hours and Safety Standards Act)

Subpart A - Davis-Bacon and Related Acts Provisions and Procedures

Source: 48 FR 19540, Apr. 29, 1983, unless otherwise noted.

Authority: 5 U.S.C. 301; R.S. 161, 64 Stat. 1267; Reorganization Plan No. 14 of 1950, 5 U.S.C. appendix; 40 U.S.C. 3141 *et seq.;* 40 U.S.C. 3145; 40 U.S.C. 3148; 40 U.S.C. 3701 *et seq.;* and the laws listed in 5.1(a) of this part; Secretary's Order No. 01-2014 (Dec. 19, 2014), 79 FR 77527 (Dec. 24, 2014); 28 U.S.C. 2461 note (Federal Civil Penalties Inflation Adjustment Act of 1990); Pub. L. 114-74 at sec. 701, 129 Stat 584.

Source: 48 FR 19541, Apr. 29, 1983, unless otherwise noted.

Editorial Note: Nomenclature changes to subpart A of part 5 appear at 61 FR 19984, May 3, 1996.

§ 5.5 Contract provisions and related matters.

(a) The Agency head shall cause or require the contracting officer to insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) ***Minimum wages.***

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics

performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)

(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is utilized in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) ***Withholding.*** The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) ***Payrolls and basic records.***

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)

(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the

payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at *http://www.dol.gov/esa/whd/forms/wh347instr.htm* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(*1*) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(*2*) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such

representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) ***Apprentices and trainees*** -

(i) ***Apprentices.*** Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) ***Trainees.*** Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress,

expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) ***Equal employment opportunity.*** The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) ***Contract Work Hours and Safety Standards Act.*** The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by § 5.5(a) or § 4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $31 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) ***Withholding for unpaid wages and liquidated damages.*** The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) ***Subcontracts.*** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in § 5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including

guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

(The information collection, recordkeeping, and reporting requirements contained in the following paragraphs of this section were approved by the Office of Management and Budget:

Paragraph	OMB Control No.
(a)(1)(ii)(B)	1235-0023
(a)(1)(ii)(C)	1235-0023
(a)(1)(iv)	1235-0023
(a)(3)(i)	1235-0023
(a)(3)(ii)(A)	1235-0023
	1235-0008
(c)	1235-0023

[48 FR 19540, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 55 FR 50150, Dec. 4, 1990; 57 FR 28776, June 26, 1992; 58 FR 58955, Nov. 5, 1993; 61 FR 40716, Aug. 5, 1996; 65 FR 69693, Nov. 20, 2000; 73 FR 77511, Dec. 19, 2008; 81 FR 43450, July 1, 2016; 82 FR 2225, 2226, Jan. 9, 2017; 83 FR 12, Jan 2, 2018; 84 FR 218, Jan. 23, 2019; 87 FR 2334, Jan. 14, 2022; 88 FR 2215, Jan. 13, 2023]

"General Decision Number: MD20230035 02/03/2023

Superseded General Decision Number: MD20220035

State: Maryland

Construction Type: Building

County: Howard County in Maryland.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023
1	01/13/2023

2 02/03/2023

ASBE0024-007 04/01/2021

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 39.27	18.67+a

Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems

a. PAID HOLIDAYS: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day,the day after Thanksgiving and Christmas Day provided the employee works the regular work day before and after the paid holiday.

BRMD0001-011 05/01/2022

	Rates	Fringes
BRICKLAYER (Excluding Pointing, Caulking and Cleaning)	$ 35.20	12.85

CARP0197-006 05/01/2022

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Form Work, Metal Stud Installation and Scaffold Building, Excluding Acoustical)	$ 31.40	13.86

CARP0219-002 05/01/2022

	Rates	Fringes
MILLWRIGHT	$ 34.90	16.71

CARP0474-002 05/01/2022

	Rates	Fringes
PILEDRIVERMAN	$ 34.62	16.36

ELEC0024-012 05/29/2022

	Rates	Fringes
ELECTRICIAN (Including low voltage wiring for and installation of alarms; HVAC controls)	$ 42.75	5.25%+16.94

ELEC0024-013 05/29/2022

	Rates	Fringes
ELECTRICIAN (Communication and Sound Equipment)	$ 30.90	4.75%+14.45

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving, Christmas Day

---

ENGI0037-028 04/01/2021

	Rates	Fringes
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 29.78	13.15+a
OPERATOR: Bulldozer	$ 33.79	13.15+a
OPERATOR: Forklift	$ 33.79	13.15+a
OPERATOR: Gradall	$ 33.79	13.15+a
OPERATOR: Loader (Front End)		
1 1/4 yards and over	$ 33.79	13.15+a
1 Yard and Under	$ 29.78	13.15+a
OPERATOR: Roller excluding Asphalt	$ 26.15	13.15+a

a. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

IRON0005-020 06/01/2021

	Rates	Fringes
GLAZIER	$ 31.17	24.16
IRONWORKER (Fence Erection-Chain Link/Cyclone)	$ 31.17	24.16
IRONWORKER, ORNAMENTAL, REINFORCING AND STRUCTURAL	$ 31.17	24.16
IRONWORKER, SHEETING	$ 31.17	24.16

LABO0710-004 04/01/2022

	Rates	Fringes
LABORER: Mason Tender - Cement/Concrete	$ 21.06	6.06

PAIN0051-024 06/01/2022

	Rates	Fringes
PAINTER		
Brush, Roller, Spray, Drywall Finisher/Taper and Paperhanger	$ 26.61	11.41
Industrial	$ 33.05	12.48

PLAS0891-005 07/01/2021

	Rates	Fringes
PLASTERER (Including Fireproofing)	$ 30.53	7.93

PLAS0891-006 02/01/2020

	Rates	Fringes

CEMENT MASON/CONCRETE FINISHER...$ 28.82 11.68

---

* PLUM0486-014 12/16/2022

	Rates	Fringes
PIPEFITTER (Including HVAC Pipe Installation).....	$ 44.66	23.38

ROOF0030-033 07/01/2022

	Rates	Fringes
ROOFER, Excludes Installation of Metal Roofs.....	$ 28.45	13.71

SFMD0669-001 01/01/2023

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	$ 38.67	25.22

SHEE0100-026 05/01/2022

	Rates	Fringes
SHEET METAL WORKER, Includes HVAC Duct Installation (Excludes Metal Roof Installation).....	$ 36.58	22.31

---

* SUMD2010-083 04/30/2010

	Rates	Fringes
ABATEMENT WORKER: ASBESTOS (Removal from Mechanical Systems).....	$ 12.60 **	3.91
CARPENTER (Acoustical Ceiling Installation Only).....	$ 16.00 **	2.60
ELEVATOR MECHANIC.....	$ 29.66	9.34
LABORER: Common or General.....	$ 11.63 **	1.41
LABORER: Grade Checker.....	$ 16.00 **	2.90
LABORER: Landscape.....	$ 10.00 **	0.00
LABORER: Mason Tender - Brick...	$ 14.76 **	7.73
LABORER: Mason Tender - Stone...	$ 14.03 **	0.00
LABORER: Mortar Mixer.....	$ 16.61	9.08
LABORER: Pipelayer.....	$ 13.70 **	4.11
LABORER: Mason Tender (For Pointing, Caulking and Cleaning).....	$ 12.93 **	0.00
MASON - STONE.....	$ 29.82	10.05

OPERATOR: Asphalt Roller.....$ 21.35 5.38

OPERATOR: Backhoe.....$ 22.78 5.94

OPERATOR: Boom.....$ 21.44 8.29

OPERATOR: Crane.....$ 20.75 3.11

OPERATOR: Excavator.....$ 16.95 5.69

OPERATOR: Grader/Blade.....$ 14.50 ** 4.35

OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....$ 16.73 5.02

PLUMBER.....$ 28.22 11.12

POINTER, CAULKER, CLEANER, Includes pointing, caulking, cleaning of existing masonry, brick, stone and cement structures (restoration work); excludes pointing, caulking, cleaning of new or replacement masonry, brick, stone or cement.....$ 19.75 0.00

SHEET METAL WORKER (Metal Roofs Installation).....$ 17.00 2.55

TILE FINISHER.....$ 17.32 0.00

TILE SETTER.....$ 21.38 4.65

TRUCK DRIVER: Dump Truck.....$ 15.40 ** 1.96

TRUCK DRIVER: Tractor Haul Truck.....$ 17.87 9.98

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic

violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISIO"

PROJECT MANUAL

for the

CONTROLS UPGRADE

at

BONNIE BRANC MIDDLE SCHOOL

(HCPSS BID #100.23.B3)

Prepared for:

HOWARD COUNTY PUBLIC SCHOOL SYSTEM
9020 Mendenhall Court
Columbia, Maryland 21045

100% CONSTRUCTION DOCUMENTS

MARCH 31, 2023

Prepared by:

8600 Foundry Street, Suite 306
Mill Box 2054
Savage, MD 20763
(410) 696-4512
www.building-dynamics.com

(BDL Project # 202303)

TABLE OF CONTENTS

010000 – GENERAL REQUIREMENTS

A. RELATED DOCUMENTS

1. Drawings, and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to all mechanical and electrical work.

B. SCOPE

1. All work shall be complete and ready for satisfactory service.

2. The contract drawings are diagrammatic and are intended to convey the general arrangement of the work.

3. The contractor is responsible for the means, methods, and work scheduling associated with the installation of the mechanical and electrical systems.

C. CODES AND STANDARDS

1. All work shall be performed in accordance with the edition of the following codes and standards that have been adopted by the authority having jurisdiction:

   a. American Society of Testing and Materials (ASTM)
   b. American National Standards Institute (ANSI)
   c. National Electric Code (NEC)
   d. Underwriters Laboratories (UL)

2. In the event the contract documents are in conflict with the applicable codes, the requirements of the applicable codes shall apply.

D. PERFORMANCE AND PAYMENT BOND

1. Provide a performance and payment bond for the project.

E. PERMITS

1. The contractor shall obtain all permits and certificates of inspection required by the authority having jurisdiction. There is no permit charge for the Howard County Public School System.

2. Prior to submitting the permit application, the contractor shall print the required number of sets of permit drawings and deliver them to the engineer to sign and seal. The engineer will return the signed and sealed permit sets to the contractor for his use in submitting the permit application.

F. SITE EXAMINATION

1. The contractor shall examine the site and observe the conditions under which the work will be installed. No allowances will be made for errors or omissions resulting from the contractor's failure to completely examine the site.

G. SUBCONTRACTOR AND MANUFACTURER LIST

1. Subcontractors and equipment manufacturers shall be listed on the Form of Proposal (Section 00300).

END OF SECTION 01000

010100 – SPECIAL REQUIREMENTS

A. FIRE PREVENTION

1. Each contractor shall:

   a. Avoid accumulation of flammable debris and waste within the building and vicinity. Avoid large and unnecessary accumulations of combustible forms and form lumber.
   b. Store flammable or volatile liquids in the open or in small detached structure or trailers. Handle liquids with low flash points that are to be used within the building in approved safety cans. Supervise closely the storage of paint materials and other combustible finishing and cleaning products. Do not permit oily rags to be stored in closets or other tight permanent spaces.
   c. Tobacco use is prohibited on the school property.
   d. Closely supervise welding and torch cutting operations near combustible materials.
   e. Use only fire-resistant building paper, plastic sheet, and tarpaulins for temporary protection.
   f. Do not store combustible material outdoors within 10 feet of a building or structure.
   g. Do not use gasoline for cleaning within the building under any circumstances.
   h. Do not burn any trash or other material on site.
   i. Take other precautions suitable for hazardous conditions at the site to prevent fire.

B. ACCIDENT PREVENTION AND SAFETY

1. Each contractor shall:

   a. Comply with all applicable laws, ordinances, rules, regulations, and orders of governing authorities having jurisdiction for the safety of persons and property to protect them from damage, injury, or loss.
   b. Erect and maintain, as required by conditions and progress of the work, all necessary safeguards for safety and protection, including fences, railings, barricades, lighting, posting of danger signs and other warnings against hazards.

C. PROJECT SCHEDULE

1. Major construction milestones shall be as scheduled below. Should the contractor fail to complete major milestones as scheduled, the owner may issue a cure notice or take any action deemed necessary to return the delayed major milestones and any related successor functions back on schedule, as soon as possible, at the contractor's expense.

2. The contractor shall develop a detailed project schedule, approximately sequencing all required work, including shop drawing submittals, equipment fabrication periods, etc.

3. Major construction milestones shall be as follows:

Pre-Bid Meeting:	April 28, 2023, 10:00 a.m.
Bids Due:	May 15, 2023, 1:00 p.m.
Contract Award:	May 11, 2023
Begin Construction	June 19, 2023
Submittals Due:	June 22, 2023
Substantial Completion:	August 18, 2023
Commissioning Complete:	September 1, 2023
Punchlist Completed:	September 15, 2023
Closeout Documents:	September 22, 2023

END OF SECTION 010100

011000 – SUMMARY

A. WORK IN EXISTING BUILDINGS

1. Sufficient provisions shall be made to protect occupied areas from all dirt and debris resulting from the work.

2. Where mechanical and electrical systems pass through renovated areas to serve other portions of the building, they shall remain or be suitably relocated and the system restored to normal operation.

B. OUTAGES

1. All proposed outages of the mechanical and electrical systems that are required for the proper execution and completion of the work by the contractor shall be requested by the contractor in writing at least one week in advance.

2. The contractor shall inform the owner of all systems that will be affected by the outages and also the duration of each outage.

3. The owner shall determine the date and time of each outage in order to minimize the disruption to the operation of the facility. In most cases, outages will be scheduled to occur outside of normal business hours. Additional compensation to the contractor shall not be made for any work associated with the outages.

4. The owner will be responsible to notify all affected personnel and to ensure that all affected systems are prepared for the outages.

5. The contractor shall be responsible for all work associated with the shutting down and starting up the affected systems which may include, but not be limited to, normal electric power, fire protection, plumbing, and HVAC systems.

6. The contractor may, at his option, pay to have the owner's personnel to be on-site during an outage to assist the contractor in coordinating the shutting down and starting up of the affected systems.

7. Where the duration of the proposed outages cannot be tolerated by the owner, the contractor shall provide temporary connection as required to maintain service.

C. CLEAN-UP

1. Throughout the course of the work, the contractor shall keep the premises free from the accumulation of dirt and debris.

2. Upon completion of the work, the contractor shall clean the premises to the satisfaction of the owner.

D. EXISTING SERVICES

1. The contractor shall verify the size and location of all existing services. The contractor shall notify the engineer of all discrepancies that exist between the

contract documents and the existing services before making any connections to the existing services.

E. DEMOLITION

1. Demolition shall be performed as neatly as practical and with the minimum disruption to the building activities and occupants.

2. Remove all existing hangers and supports associated with the demolition work.

3. All equipment and materials being removed, and not indicated to be given to the owner, shall be disposed of by the contractor in accordance with all federal, state, and local laws, ordinances, rules, and regulations.

4. All equipment and materials indicated to be reused or given to the owner shall be carefully removed so as not to damage the equipment or material or affect its reuse. Any such equipment and materials damaged by the contractor shall be replaced new by the contractor at no expense to the owner.

5. Should the contractor encounter any known or suspected asbestos containing materials at any time during the course of the work, all workers shall be removed from the affected area and the Owner shall be notified immediately and await instructions from the Owner.

6. Should the contractor encounter any known or suspected lead paint at any time during the course of the work, it shall not be disturbed. The contractor shall immediately notify the Owner who will then take samples to have analyzed by a laboratory. Do not disturb suspected lead paint until the results of the paint samples have been obtained and further direction given to the contractor.

7. If hazardous materials removal is required, the Contractor shall utilize the on-call abatement contractor for HCPSS: Asbestos Specialist, Inc., PO Box 368, Linthicum Heights, MD 21090. POC: Sam Chairs III, 410-796-5379.

END OF SECTION 011000

013100 – PROJECT MANAGEMENT AND COORDINATION

A. CONSTRUCTION SUPERINTENDENT

1. The contractor shall provide a construction superintendent at the site at all times to oversee the mechanical and electrical work and be responsible for its accuracy.

B. PROGRESS MEETINGS

1. Conduct a pre-construction meeting prior to beginning construction.
2. Conduct construction progress meetings at bi-weekly intervals at the project site.
3. The engineer will record and distribute the meeting minutes.

C. COORDINATION WITH BGE

1. As required, the contractor shall coordinate all activities associated with the Baltimore Gas and Electric Company (BGE).

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 016000 "Product Requirements" for submitting warranties and substitutions.
2. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

A. Within nor more than fourteen (14) calendar days after the award of the contract, the Contractor shall provide submittals to the Engineer for approval for all equipment and materials proposed for the work. Equipment and materials for which submittals are not

provided within fourteen (14) calendar days shall be provided as specified. Other products will not be allowed.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of firm or entity that prepared submittal.
5. Names of subcontractor, manufacturer, and supplier.
6. Contractor shall create and maintain a submittal log. Each submittal shall have a unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
7. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
8. Drawing number and detail references, as appropriate.
9. Other necessary identification.
10. Remarks.
11. Signature of transmitter.

B. Options: Identify options requiring selection by Engineer.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Engineer by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.
    a. Engineer will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 10 days for initial review of each submittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Notation of coordination requirements.
    c. Notation of dimensions established by field measurement.
    d. Relationship and attachment to adjoining construction clearly indicated.
2. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches , but no larger than 30 by 42 inches .
    a. One PDF copy of each submittal. Engineer will return one copy with review comments.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

D. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.

2. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
3. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

E. Test and Research Reports:

1. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
2. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp . Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ENGINEER'S REVIEW

A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required , and return.

1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action .

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Engineer will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Engineer without action.

G. No work shall be fabricated or equipment ordered until the Engineer's approval has been given on the submittal.

H. Approval of submittals by the Engineer does not relieve the Contractor of their responsibility to provide the equipment and materials specified in the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

016000 – PRODUCT REQUIREMENTS

A. MANUFACTURER'S WARRANTIES

1. All equipment and materials shall be new and installed in accordance with the manufacturer's instructions and conditions for warranty. In the event the contract documents are in conflict with the manufacturer's conditions for warranty, the equipment shall be installed in accordance with the manufacturer's instructions so as not to void any manufacturer's warranties.

B. PRODUCT SELECTION PROCEDURES

1. The contract documents describe systems designed in accordance with the equipment manufacturers specified. The contractor shall bear the cost of all appurtenances required for deviations from the equipment specified. These appurtenances shall include, but are not limited to: architectural, structural, mechanical, and electrical modifications necessary to install the equipment in accordance with the manufacturer's instructions.

2. The contractor shall use products of one manufacturer where two or more items of the same type of equipment are required.

3. The contractor shall notify the engineer of any changes in the electrical characteristics of the equipment being installed in contradiction to that described in the contract documents.

C. SUBSTITUTIONS

1. In the case where two (2) or more equipment manufacturers are specified, the contractor shall provide equipment by one of the specified manufacturers.

2. Any deviation from the specified equipment manufacturers shall constitute a substitution and shall be submitted to the engineer for approval as a request for substitution. The contractor must certify in his request that the proposed substitution complies with the requirements of the contract documents.

D. CLEARANCES

1. The contractor shall insure that adequate clearance exists for the installation and maintenance of all work shown on the drawings and described in the specifications.

E. ACCESSIBILITY

1. The contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible locations.

END OF SECTION 016000

017329 – CUTTING AND PATCHING

A. GENERAL

1. Unless otherwise directed, the contractor shall perform all cutting and patching required by the mechanical and electrical work.

2. The contractor shall not cut reinforced concrete or structural steel without the engineer's approval.

3. All patching shall be uniform in appearance and shall match the surrounding surface.

4. The contractor shall repair any damage to the existing building or furnishings resulting from the mechanical and electrical work.

END OF SECTION 017329

017700 – CLOSEOUT PROCEDURES

A. CONTRACTOR'S WARRANTY

1. The contractor shall warranty all mechanical and electrical work to be free from defects and installation deficiencies for a period of two years after the date of acceptance by the owner.
2. During the contractor's warranty period, the contractor shall repair all mechanical and electrical systems as required, including all necessary parts and labor, at no cost to the owner.

B. MANUFACTURER'S WARRANTIES

1. The contractor shall deliver to the owner all certificates of manufacturer's warranties which extend beyond the contractor's warranty period.

END OF SECTION 017700

017823 – OPERATION AND MAINTENANCE DATA

A. OPERATION AND MAINTENANCE MANUALS

1. Upon completion of the work, the contractor shall submit to the engineer for approval three (3) hard copies of operation and maintenance (O&M) manuals in 3-ring binders and one (1) Adobe Acrobat file on CD of the O&M manual for all mechanical and electrical equipment. Included in each manual shall be:

    a. All approved submittals.
    b. As-built mechanical drawings.
    c. As-built automatic temperature control drawings.
    d. All manufacturers' technical and product information, rated capacities, accessories, maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list, source information, and warranties.
    e. Contractor’s warranty (two years from the date of acceptance by the owner).
    f. Approved testing, adjusting, and balancing report.
    g. Other pertinent information for each piece of equipment.

Note: Assemble the entire O&M manual, including the items listed above, into a single Adobe Acrobat file, with dividers identifying each section (approved submittals, as-built ATC shop drawings, etc.), and e-mail it to the engineer to review prior to submitting the one (1) hard copy of the O&M manuals to the engineer. (This cannot be done until the engineer has received, reviewed, and approved the testing, adjusting, and balancing report.) After receiving and incorporating the engineer’s comments into the O&M manual, send one (1) hard copies and one (1) Adobe Acrobat file on CD of the O&M manual to the engineer for final review and acceptance.

END OF SECTION 017823

017839 – PROJECT RECORD DOCUMENTS

A. RED-LINED MARK-UP SET

1. Throughout the course of the construction, the contractor shall maintain at the site one (1) set of prints in good condition indicating in red ink any deviations from the original contract drawings.

B. RECORD DRAWINGS

1. Upon completion of the work, the contractor shall submit to the engineer for approval a reproducible set of record drawings and an Adobe Acrobat file clearly showing the location of equipment, piping, and ductwork, and any deviations from the original contract drawings.

END OF SECTION 017839

017900 – DEMONSTRATION AND TRAINING

A. DEMONSTRATION

1. Upon completion of the work, the contractor shall demonstrate to the owner's satisfaction that all components of the work are connected, calibrated, and operating in accordance with the design sequence of operations in all modes of operation.

2. Confirm that all safeties are functioning properly on all HVAC units.

3. Demonstrate to the owner’s satisfaction that all automatic temperature controls for the HVAC systems have been fully integrated into the existing JCI Metasys, Honeywell Tridium, or Schneider Electric Ecostruxure building automation system at the central maintenance office on Mendenhall Court.

B. TRAINING

1. Thoroughly instruct the owner's representatives for no less than four (4) hours in the proper operation, adjustment, and maintenance of all mechanical and electrical products, equipment, and systems.

C. VIDEOTAPING

1. Demonstration and training sessions shall be professionally videotaped by the contractor. The recording shall be provided to the Owner on a compact disc as part of the closeout documents.

2. Describe scenes on the videotape by audio narration by microphone while videotape is being recorded. Include descriptions of items being viewed.

END OF SECTION 017900

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

C. Motors used with Variable Frequency Drives shall be provided with a shaft ground ring to protect the motor bearings from premature failure

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F .

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T .

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.
   j. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White .
4. Background Color: Black .
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.1 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1.2 QUALITY ASSURANCE

A. TAB Specialists Qualifications: AABC NEBB or TABB certified.

1.3 SUMMARY

A. TAB for the following:

1. Air and Water Systems at the HVAC equipment listed below:
   a. Rooftop variable-air-volume AHUs, excluding VAV boxes.
   b. Rooftop constant air volume AHUs.
   c. Fan Coil Units.
   d. DX Split Systems with duct-mounted hot water coils.
2. Automatic temperature control system verification.

1.4 EXECUTION

A. Tolerances:

1. Supply, Return and Outside Air Volumes for HVAC equipment: Plus or minus 10 percent. If design value is less than 100 cfm, tolerance is to be within 10 cfm.
2. Maintaining design pressure relationships is to take priority over specific tolerances.

B. Balancing of Variable Air Volume Systems:

1. Balance variable air volume systems in accordance with AABC standards for Testing and Balancing Variable Volume Systems.
2. Adjust the supply air duct static pressure to satisfy the requirements of the terminal unit with the greatest static pressure loss.

C. Pre-Balancing Procedures:

1. Replace all air filters prior to performing balancing.
2. Clean all strainers prior to performing water balancing.

D. Measurements and Adjustments:

1. Measure and record the following at each water coil:

a. Location/equipment designation.
b. Water flow rate (design – actual).
c. Entering and leaving water temperatures (design – actual).
d. Water pressure drop (design – actual).
e. Airflow (design – actual).
f. Entering and leaving air temperatures (design – actual).
g. Air pressure drop (design – actual).

2. Measure and record the following for each air-handling unit:

a. Equipment designation.
b. Manufacturer's name, model number, and serial number.
c. Fan motor horsepower rating.
d. Fan brake horsepower.
e. Fan rpm (design – actual).
f. Motor rpm.
g. Efficiency rating.
h. Starter thermal protection element rating.
i. Nameplate and measured voltage, each phase.
j. Nameplate and measured amperage, each phase.
k. Static air pressure conditions across fans, coils and filters.
l. Total and external static pressures (design – actual).
m. Adjust outside air, return air, and relief air dampers for the design conditions.
n. Supply, outdoor, return, and relief airflows (design – actual).
o. Heating coil entering and leaving dry bulb temperatures (design – actual).
p. Heating coil entering and leaving water temperatures, flow rate, and pressure drop (design – actual).
q. Cooling coil entering and leaving dry bulb and wet bulb temperatures (design – actual).
r. Cooling coil entering and leaving water temperatures, flow rate, and pressure drop (design – actual).

E. Inspections:

1. Random checks by TAB specialist's test and balance engineer in the presence of Owner to verify final TAB report.
2. Owner to randomly select measurements, documented in the final report, to be rechecked. Rechecking to be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal eight-hour business day.

F. Additional Tests:

1. Random tests within 90 days of completing TAB to verify balance conditions and seasonal tests.
2. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Direct digital control (DDC) system equipment and components for monitoring and controlling of HVAC, exclusive of instrumentation and control devices.

1.2 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems to be capable of operating in a standalone mode using the last best available data.

J. E/P: Voltage to pneumatic.

K. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

L. HLC: Heavy load conditions.

M. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

N. I/P: Current to pneumatic.

O. LAN: Local area network.

P. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

Q. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

R. Modbus TCP/IP: An open protocol for exchange of process data.

S. MS/TP: Master-slave/token-passing, ISO/IEC/IEEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

T. MTBF: Mean time between failures.

U. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

V. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

W. Peer to Peer: Networking architecture that treats all network stations as equal partners.

X. POT: Portable operator's terminal.

Y. RAM: Random access memory.

Z. RF: Radio frequency.

AA. Router: Device connecting two or more networks at network layer.

BB. Server: Computer used to maintain system configuration, historical and programming database.

CC. TCP/IP: Transport control protocol/Internet protocol.

DD. UPS: Uninterruptible power supply.

EE. USB: Universal Serial Bus.

FF. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

GG. VAV: Variable air volume.

HH. WLED: White light emitting diode.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Shop Drawings:

1. General Requirements:
   a. Include cover drawing with Project name, location, Owner, Architect, Contractor, and issue date with each Shop Drawings submission.
   b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
   c. Drawings Size: 11 inches by 17 inches. .
2. Include plans, elevations, sections, and mounting details where applicable.
3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Detail means of vibration isolation and show attachments to rotating equipment.
5. Plan Drawings indicating the following:
   a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork, and piping.
   b. Room names and numbers with coordinated placement to avoid interference with control products indicated.

c. Each desktop workstation network port, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
e. Network communication cable and raceway routing.
f. Proposed routing of wiring, cabling, conduit, and tubing; coordinated with building services for review before installation.

6. Schematic drawings for each controlled HVAC system indicating the following:
   a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
   b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
   c. A graphic showing location of control I/O in proper relationship to HVAC system.
   d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
   e. Unique identification of each I/O that to be consistently used between different drawings showing same point.
   f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays, and interface to DDC controllers.
   g. Narrative sequence of operation.
   h. Graphic sequence of operation, showing all inputs and output logical blocks.
7. Control panel drawings indicating the following:
   a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
   b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates, and allocated spare space.
   c. Front, rear, and side elevations and nameplate legend.
   d. Unique drawing for each panel.
8. DDC system network riser diagram indicating the following:
   a. Each device connected to network with unique identification for each.
   b. Interconnection of each different network in DDC system.
   c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
   d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.
9. DDC system electrical power riser diagram indicating the following:
   a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
   b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
   c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
   d. Power wiring type and size, race type, and size for each.
10. Monitoring and control signal diagrams indicating the following:

a. Control signal cable and wiring between controllers and I/O.
b. Point-to-point schematic wiring diagrams for each product.
c. Control signal tubing to sensors, switches, and transmitters.
d. Process signal tubing to sensors, switches, and transmitters.

B. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing, and events that initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:
   a. Loss of power.
   b. Loss of network communication signal.
   c. Loss of controller signals to inputs and outpoints.
   d. Server failure.
   e. Gateway failure.
   f. Network failure.
   g. Controller failure.
   h. Instrument failure.
   i. Control damper and valve actuator failure.
4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Submittals:

1. Field quality-control reports.

B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
   b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
   c. As-built versions of submittal Product Data.
   d. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for DDC system and products.

e. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
f. Backup copy of graphic files, programs, and databases on electronic media.
g. List of recommended spare parts with part numbers and suppliers.
h. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
i. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
j. Licenses, guarantees, and warranty documents.
k. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials and parts to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include product manufacturers' recommended parts lists for proper product operation over four -year period following warranty period. Parts list to be indicated for each year.

C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during two -year period following warranty period.

D. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:

1. Network Controller: One .
2. Programmable Application Controller: One .
3. Application-Specific Controller: One .
4. General-Purpose Relay: Two .
5. Current-Sensing Relay: Two .
6. Transformer: One .

1.8 QUALITY ASSURANCE

A. DDC System Manufacturer Qualifications:

1. Controllers shall be:
   a. Johnson Controls, Inc. (JCI) Metasys.
   b. Honeywell Tridium
   c. Schneider Ecostruxure

B. DDC System Provider Qualifications:

1. Installer shall be Johnson Controls, Inc. (JCI) or Electrical Automation Services, Inc. (EASI).

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Adjust, repair, or replace failures at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
   a. Install updates only after receiving Owner's written authorization.
3. Perform warranty service during normal business hours and commence within 24 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.
   a. For Gateway: Two -year parts and labor warranty for each.

PART 2 - PRODUCTS

2.1 DDC SYSTEM MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Johnson Controls, Inc. (JCI) Metasys.
2. Honeywell Tridium
3. Schneider Ecostruxure

2.2 DDC SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.

1. DDC system consisting of high-speed, peer-to-peer network of distributed DDC controllers , other network devices, operator interfaces, and software.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 WEB ACCESS

A. DDC system to be web compatible.

1. Web-Compatible Access to DDC System:
   a. server to perform overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
   b. DDC system to support web browser access to building data. Operator using a standard web browser is able to access control graphics and change adjustable set points.
   c. Password-protected web access.

2.4 PERFORMANCE REQUIREMENTS

A. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

B. DDC System Speed:

1. Response Time of Connected I/O:
   a. Update AI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
   b. Update BI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
   c. AO points connected to DDC system to begin to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
   d. BO point values connected to DDC system to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
2. Display of Connected I/O:
   a. Update and display analog point COV connected to DDC system at least every five seconds for use by operator.
   b. Update and display binary point COV connected to DDC system at least every five seconds for use by operator.
   c. Update and display alarms of analog and digital points connected to DDC system within 30 seconds of activation or change of state.
   d. Update graphic display refresh within eight seconds.
   e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations to not exceed graphic refresh rate indicated.

C. Network Bandwidth: Design each network of DDC system to include spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions. Minimum spare bandwidth as follows:

1. Level 1 Networks: 20 .

2. Level 2 Networks: 20 .
3. Level 3 Networks: 10 .
4. .

D. DDC System Data Storage:

1. Include capability to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends, and other information indicated.
2. Local Storage:
   a. Coordinate with existing server to ensure data storage indicated. Server(s) to use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.

E. DDC Data Access:

1. When logged into the system, operator able to also interact with any DDC controllers connected to DDC system as required for functional operation of DDC system.
2. Use for application configuration; for archiving, reporting, and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.

F. Future Expandability:

1. DDC system size is expandable to an ultimate capacity of at least 1.5 times total I/O points indicated.
2. Design and install system networks to achieve ultimate capacity with only addition of DDC controllers, I/O, and associated wiring and cable. Design and install initial network infrastructure to support ultimate capacity without having to remove and replace portions of network installation.
3. Operator interfaces installed initially do not require hardware and software additions and revisions for system when operating at ultimate capacity.

G. Input Point Values Displayed Accuracy: Meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.

1. Gas:
   a. Carbon Dioxide: Within 50 ppm.
2. Moisture (Relative Humidity):
   a. Air: Within 5 percent RH.
   b. Space: Within 5 percent RH.
3. Speed: Within 5 percent of reading.
4. Temperature, Dry Bulb:
   a. Space: Within 0.5 deg F .
   b. Other Temperatures Not Indicated: Within 1 deg F .

H. Precision of I/O Reported Values: Values reported in database and displayed to have following precision:

1. Current:
   a. Milliamperes: Nearest 1/100th of a milliampere.
   b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.
2. Gas:
   a. Carbon Dioxide (ppm): Nearest ppm.
3. Moisture (Relative Humidity):
   a. Relative Humidity (Percentage): Nearest 1 percent.
4. Speed:
   a. Rotation (rpm): Nearest 1 rpm.
   b. Velocity: Nearest 1/10th of feet per minute through 100 fpm; nearest feet per minute between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.
5. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
6. Temperature:
   a. Space: Nearest 1/10th of a degree.
7. Voltage: Nearest 1/10 V up to 100 V; nearest volt above 100 V.

I. Control Stability: Control variables indicated within the following limits:

1. Flow:
   a. Air, Ducts and Equipment, except Terminal Units: Within 5 2 percent of design flow rate.
   b. Air, Terminal Units: Within 10 5 percent of design flow rate.
2. Gas:
   a. Carbon Dioxide: Within 50 ppm.
3. Moisture (Relative Humidity):
   a. Air: Within 5 percent RH.
   b. Space: Within 5 percent RH.
4. Temperature, Dry Bulb:
   a. Space: Within 2 deg F .

J. Environmental Conditions for Controllers, Gateways, and Routers:

1. Products to operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.
   a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure to be internally insulated, electrically heated, cooled, and ventilated as required by product and application.
2. Protect products with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House products not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location dictates the following NEMA 250 enclosure requirements:
   a. Outdoors, Protected: Type 3 .
   b. Outdoors, Unprotected: Type 4 .
   c. Indoors, Heated with Non-Filtered Ventilation: Type 2orType 12 .
   d. Mechanical Equipment Rooms:
      1) Chiller and Boiler Rooms: Type 12 .
   e. .

K. Environmental Conditions for Instruments and Actuators:

1. Protect instruments, actuators, and accessories with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House instruments and actuators not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location is to dictate the following NEMA 250 enclosure requirements:
   a. Outdoors, Protected: Type 12 .
   b. Outdoors, Unprotected: Type 4 .

L. DDC System Reliability:

1. Design, install, and configure DDC controllers, gateways, routers, to yield a MTBF of at least 20,000 hours, based on a confidence level of at least 90 percent. MTBF value includes any failure for any reason to any part of products indicated.
2. If required to comply with MTBF indicated, include DDC system and product redundancy to maintain DCC system, and associated systems and equipment being controlled, operational, and under automatic control.
3. See Drawings for critical systems and equipment that require a higher degree of DDC system redundancy than MTBF indicated.

M. Electric Power Quality:

1. Power-Line Surges:
   a. Protect susceptible DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.1 and IEEE C62.41.2.
   b. Do not use fuses for surge protection.
   c. Test protection in the normal mode and in the common mode, using the following two waveforms:
      1) 10-by-1000-microsecond waveform with a peak voltage of 1500 V and a peak current of 60 A.
      2) 8-by-20-microssecond waveform with a peak voltage of 1000 V and a peak current of 500 A.
2. Ground Fault: Protect products from ground fault by providing suitable grounding. Products to not fail due to ground fault condition.

N. Backup Power Source:

1. Serve DDC system products that control HVAC systems and equipment served by a backup power source also from a backup power source.

O. UPS:

1. DDC system products powered by UPS units are to include the following:
   a. Servers.
   b. Gateways.
   c. Network and DDC controllers , except application-specific controllers.
   d. Network switches, or any other component required for communication .

P. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems are to automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.5 SYSTEM ARCHITECTURE

A. System architecture consisting of no more than three levels of LANs.

1. Level 1 LAN: Connect network controllers and operator workstations.
2. Level 2 LAN: Connect programmable application controllers to other programmable application controllers and to network controllers.
3. Level 3 LAN: Connect application-specific controllers to programmable application controllers and to network controllers .

B. Minimum Data Transfer and Communication Speed:

1. LAN Connecting Operator Workstations and Network Controllers: 100 Mbps.
2. LAN Connecting Programmable Application Controllers: 1000 kbps.
3. LAN Connecting Application-Specific Controllers: 9800 bps.

C. Provide dedicated and separated DDC system LANs that are not shared with other building systems and tenant data and communication networks.

D. Provide modular system architecture with inherent ability to expand to not less than 1.5 times system size indicated with no impact to performance indicated.

E. Configure architecture to minimize need to remove and replace existing network equipment for system expansion.

F. Make number of LANs and associated communication transparent to operator. Configure all I/O points residing on any LAN to be capable of global sharing between all system LANs.

G. Design system to eliminate dependence on any single device for system alarm reporting and control execution. Design each controller to operate independently by performing own control, alarm management, and historical data collection.

H. Special Network Architecture Requirements:

1. Coordinate all network naming, architecture, addressing and other requirements with HCPSS IT Department and BAS Group to obtain network drop and ensure acceptable integration with the existing JCI Metasys network/database .

2.6 DDC SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access: Operator able to access entire DDC system through any of multiple means including, but not limited to, the following:

1. Portable operator terminal with hardwired connection through LAN port.
2. Remote connection through web access.

B. Make access to system, regardless of operator means used, transparent to operator.

C. Network Ports: For hardwired connection of desktop or portable workstation. Network port easily accessible, properly protected, clearly labeled, and installed at the following locations:

1. Each mechanical equipment room.
2. Each boiler room.
3. Maintenance office.

D. Critical Alarm Reporting:

1. Send operator-selected critical alarms to notify operator of critical alarms that require immediate attention.
2. Send alarm notification to multiple recipients that are assigned for each alarm.
3. Notify recipients by any or all means, including email, text message, and prerecorded phone message to mobile and landline phone numbers.

E. Simultaneous Operator Use: Capable of accommodating up to five simultaneous operators that are accessing DDC system through any of operator interfaces indicated.

2.7 NETWORKS

A. Acceptable networks for connecting workstations, mobile devices, and network controllers include the following:

1. IP.
2. ISO/IEC/IEEE 8802-3, Ethernet.

B. Acceptable networks for connecting programmable application controllers include the following:

1. IP.
2. ISO/IEC/IEEE 8802-3, Ethernet.

2.8 NETWORK COMMUNICATION PROTOCOL

A. Use network communication protocol(s) that are open to Owner and available to other companies for use in making future modifications to DDC system.

B. ASHRAE 135 Protocol:

1. Use ASHRAE 135 communication protocol as sole and native protocol used throughout entire DDC system.
2. DDC system to not require use of gateways except to integrate HVAC equipment and other building systems and equipment; not required to use ASHRAE 135 communication protocol.
3. If used, gateways to connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
4. Use operator workstations, controllers, and other network devices that are tested and listed by BTL.

C. Industry Standard Protocols:

1. Use any one or a combination of the following industry standard protocols for network communication while complying with other DDC system requirements indicated:
   a. ASHRAE 135.
2. Operator workstations and network controllers are to communicate through ASHRAE 135 protocol.
3. Provide portions of DDC system networks using ASHRAE 135 communication protocol as an open implementation of network devices complying with ASHRAE 135. Use network devices that are tested and listed by BTL.

2.9 ASHRAE 135 GATEWAYS

A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable. BACnet-controlled plant equipment includes, but is not limited to, boilers, chillers, and variable-speed drives.

B. Include gateways to connect BACnet to legacy systems where indicated, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment.

C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.

D. Gateway Minimum Requirements:

1. Read and view all readable object properties on non-BACnet network to BACnet network, and vice versa, where applicable.
2. Write to all writable object properties on non-BACnet network from BACnet network, and vice versa, where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet, and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs in accordance with ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.

6. Backup programming and parameters on CD media with ability to modify, download, backup, and restore gateway configuration.

2.10 DDC CONTROLLERS

A. DDC system consisting of a combination of network controllers, programmable application controllers, and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers to perform monitoring, control, energy optimization, and other requirements indicated.

C. DDC controllers are to use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller is capable of full and complete operation as a completely independent unit and as a part of DDC system wide distributed network.

E. Environment Requirements:

1. Controller hardware suitable for anticipated ambient conditions.
2. Controllers located in conditioned space rated for operation at 32 to 120 deg F .
3. Controllers located outdoors rated for operation at 40 to 150 deg F .

F. Power and Noise Immunity:

1. Operate controller at 90 to 110 percent of nominal voltage rating and perform an orderly shutdown below 80 percent of nominal voltage.
2. Protect against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

G. DDC Controller Spare Processing Capacity:

1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
   a. Network Controllers: 50 percent.
   b. Programmable Application Controllers: Not less than 60 percent.
2. Memory for DDC controller's operating system and database are to include the following:
   a. Monitoring and control.
   b. Energy management, operation, and optimization applications.
   c. Alarm management.
   d. Historical trend data of all connected I/O points.
   e. Maintenance applications.
   f. Operator interfaces.
   g. Monitoring of manual overrides.

H. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:

1. Network Controllers:
   a. 20 percent of each AI, AO, BI, and BO point connected to controller.
   b. Minimum Spare I/O Points per Controller:
      1) AIs: Two .
      2) AOs: Two .
      3) BIs: Three .
      4) BOs: Three .
      5) Option to provide universal I/O to meet spare requirements.
2. Programmable Application Controllers:
   a. 10 percent of each AI, AO, BI, and BO point connected to controller.
   b. Minimum Spare I/O Points per Controller:
      1) AIs: Two .
      2) AOs: Two .
      3) BIs: Three .
      4) BOs: Three .
      5) Option to provide universal I/O to meet spare requirements.

I. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

J. I/O Point Interface:

1. Connect hardwired I/O points to network, programmable application, and application-specific controllers.
2. Protect I/O points so shorting of point to itself, to another point, or to ground will not damage controller.
3. Protect I/O points from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:
   a. Include monitoring of low-voltage (0 to 10 V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
   b. Compatible with, and field configurable to, sensor and transmitters installed.
   c. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
   d. Signal conditioning including transient rejection for each AI.
   e. Capable of being individually calibrated for zero and span.
   f. Incorporate common-mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.
   g. External conversion resistors are not permitted.
5. AOs:
   a. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.

b. Output signals range of 4 to 20 mA dc or 0 to 10 V dc as required to include proper control of output device.
c. Capable of being individually calibrated for zero and span.
d. Drift is to be not greater than 0.4 percent of range per year.
e. External conversion resistors are not permitted.

6. BIs:
   a. Accept contact closures and ignore transients of less than 5 ms duration.
   b. Isolate and protect against an applied steady-state voltage of up to 180 V ac peak.
   c. Include a wetting current of at least 12 mA to be compatible with commonly available control devices and protected against effects of contact bounce and noise.
   d. Sense "dry contact" closure without external power (other than that provided by controller) being applied.
   e. Pulse accumulation input points complying with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Include buffer to totalize pulses. Pulse accumulator is to accept rates of at least 20 pulses per second. Reset the totalized value to zero on operator's command.
7. BOs:
   a. Include relay contact closures or triac outputs for momentary and maintained operation of output devices.
      1) Relay contact closures to have a minimum duration of 0.1 second and at least 180 V of isolation.
      2) Include electromagnetic interference suppression on all output lines to limit transients to non-damaging levels.
      3) Minimum contact rating to be 1 A at 24 V ac.
      4) Triac outputs to have at least 180 V of isolation and minimum contact rating of 1 A at 24 V ac.
   b. Include BOs with two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
   c. BOs to be selectable for either normally open or normally closed operation.
   d. Include tristate outputs (two coordinated BOs) for control of three-point, floating-type electronic actuators without feedback.

2.11 NETWORK CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Include enough memory to support its operating system, database, and programming requirements with spare memory indicated.
4. Share data between networked controllers and other network devices.
5. Operating system of controller to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Include network controllers with a real-time clock.

7. Controller to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller is to assume a predetermined failure mode and generate an alarm notification.
8. Make controllers fully programmable.

B. Communication:

1. Network controllers communicate with other devices on DDC system Level 1 network.
2. Network controller to also perform routing if connected to network of programmable application controllers and application-specific controllers.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation .

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Maintain Basic Input Output System (BIOS) and programming information in event of power loss for at least 96 hours.

2.12 PROGRAMMABLE APPLICATION CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide enough memory to support its operating system, database, and programming requirements with spare memory indicated.
3. Share data between networked controllers and other network devices.
4. Include controller with operating system to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Include controllers that perform scheduling with a real-time clock.
6. Controller is to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller assumes a predetermined failure mode and generates an alarm notification.
7. Fully programmable.

B. Communication:

1. Programmable application controllers are to communicate with other devices on network.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation .

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Maintain BIOS and programming information in event of power loss for at least 72 hours.

2.13 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment or system. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.

1. Capable of standalone operation and continued control functions without being connected to network.
2. Share data between networked controllers and other network devices.

B. Communication: Application-specific controllers are to communicate with other application-specific controllers and devices on network, and to programmable application controllers and network controllers.

C. Operator Interface: Equip controllers with a service communications port for connection to portable operator's workstation . Connection is to extend to port on space temperature sensor that is connected to controller.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.14 CONTROLLER SOFTWARE

A. General:

1. Software applications are to reside and operate in controllers. Edit applications through operator workstations.
2. Identify I/O points by up to 30 -character point name and up to 16 -character point descriptor. Use same names throughout, including at operator workstations.
3. Execute control functions within controllers using DDC algorithms.

4. Configure controllers to use stored default values to ensure fail-safe operation. Use default values when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Secure operator access using individual security passwords and user names.
2. Passwords restrict operator to points, applications, and system functions as assigned by system manager.
3. Record operator log-on and log-off attempts.
4. Protect from unauthorized use by automatically logging off after last keystroke. Make the delay time operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule is to consist of the following:

1. Weekly Schedule:
   a. Include separate schedules for each day of week.
   b. Each schedule should include capability for start, stop, optimal start, optimal stop, and night economizer.
   c. Each schedule may consist of up to 10 events.
   d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.
2. Exception Schedules:
   a. Include ability for operator to designate any day of the year as an exception schedule.
   b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.
3. Holiday Schedules:
   a. Include capability for operator to define up to 99 special or holiday schedules.
   b. Place schedules on scheduling calendar with ability to repeated each year.
   c. Operator able to define length of each holiday period.

D. System Coordination:

1. Include standard application for proper coordination of equipment.
2. Include operator with a method of grouping together equipment based on function and location.
3. Include groups that may be for use in scheduling and other applications.

E. Binary Alarms:

1. Set each binary point to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:

1. Provide each analog object with both high and low alarm limits.
2. Include capability to automatically and manually disable alarming.

G. Alarm Reporting:

1. Include ability for operators to determine action to be taken in event of an alarm.
2. Route alarms to appropriate operator workstations based on time and other conditions.
3. Include ability for alarms to start programs, print, be logged in event logs, generate custom messages, and display graphics.

H. Remote Communication:

1. Include ability for system to notify operators by phone message, text message, and email in event of an alarm.

I. Maintenance Management: Monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.

J. Sequencing: Include application software based on sequences of operation indicated to properly sequence chillers, boilers, and other applicable HVAC equipment.

K. Control Loops:

1. Support any of the following control loops, as applicable to control required:
    a. Two-position (on/off, open/close, slow/fast) control.
    b. Proportional control.
    c. Proportional plus integral (PI) control.
    d. Proportional plus integral plus derivative (PID) control.
        1) Include PID algorithms with direct or reverse action and anti-windup.
        2) Algorithm to calculate a time-varying analog value used to position an output or stage a series of outputs.
        3) Make controlled variable, set point, and PID gains operator-selectable.
    e. Adaptive (automatic tuning).

L. Staggered Start: Prevent all controlled equipment from simultaneously restarting after a power outage. Make the order which equipment (or groups of equipment) is started, along with the time delay between starts, operator-selectable.

M. Energy Calculations:

1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.
2. Include algorithm that calculates a sliding-window average (rolling average). Make algorithm flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
3. Include algorithm that calculates a fixed-window average. Use a digital input signal to define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.

N. Anti-Short Cycling:

1. Protect BO points from short cycling.
2. Feature to allow minimum on-time and off-time to be selected.

O. On and Off Control with Differential:

1. Include algorithm that allows BO to be cycled based on a controlled variable and set point.
2. Use direct- or reverse-acting algorithm and incorporate an adjustable differential.

P. Run-Time Totalization:

1. Include software to totalize run-times for all BI and BO points.
2. Assign a high run-time alarm, if required, by operator.

2.15 ENCLOSURES

A. General:

1. House each controller and associated control accessories in enclosure. Enclosure is to serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies, and transformers.
2. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure. Coordinate keys with HCPSS Maintenance Division.
3. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
4. Individual, wall-mounted, single-door enclosures maximum of 36 inches wide and 60 inches high.
5. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
6. Supply each enclosure with complete set of laminated as-built schematics, tubing, and wiring diagrams and product literature located in pocket on inside of door.

B. Internal Arrangement:

1. Arrange internal layout of enclosure to group and protect electric, and electronic components associated with controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling, and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 10 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install maximum of two wires on each side of terminal.
9. Include enclosure field electric power supply with toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with line-voltage nominal 20 A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with 5 A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).

12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). Nameplates are to have at least 1/4-inch- high lettering.
13. Route tubing cable and wire located inside enclosure within a raceway with continuous removable cover.
14. Label each end of cable, wire, and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 15 percent spare area on face of panel.

C. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction, and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

D. Wall-Mounted, NEMA 250, Type 1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper B-line; brand of Eaton, Electrical Sector.
   b. Hammond Mfg. Co. Inc.
   c. Hoffman; brand of nVent Electrical plc.
   d. Saginaw Control and Engineering.
2. NRTL listed in accordance with UL 50 or UL 50E.
3. Construct enclosure of steel, not less than the following:
   a. Enclosure Size Less Than 24 Inches: 0.053 inch thick.
   b. Enclosure Size 24 Inches and Larger: 0.067 inch thick.
4. Finish enclosure inside and out with polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Exterior Color: Manufacturer's standard .
   b. Interior Color: Manufacturer's standard.
5. Hinged door full size of front face of enclosure and supported using the following:
   a. Enclosures Sizes Less Than 36 Inches Tall: Multiple butt hinges.
   b. Enclosures Sizes 36 Inches Tall and Larger: Continuous piano hinges.

6. Removable internal panel with white or gray polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Size Less Than 24 Inches: Solid or perforated steel, 0.053 inch thick.
   b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch or steel, 0.093 inch thick.
7. Internal panel mounting hardware, grounding hardware, and sealing washers.
8. Grounding stud on enclosure body.
9. Thermoplastic pocket on inside of door for record Drawings and Product Data.

E. Wall-Mounted, NEMA 250, Types 4 and 12:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper B-line; brand of Eaton, Electrical Sector.
   b. Hammond Mfg. Co. Inc.
   c. Hoffman; brand of nVent Electrical plc.
   d. Saginaw Control and Engineering.
2. NRTL listed in accordance with UL 508A.
3. Seam and joints are continuously welded and ground smooth.
4. Where recessed enclosures are indicated, include enclosures with face flange for flush mounting.
5. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
6. Single-door enclosure sizes up to 60 inches tall by 36 inches wide.
7. Construct enclosure of steel, not less than the following:
   a. Size Less Than 24 Inches: 0.053 inch or 0.067 inch thick.
   b. Size 24 Inches and Larger: 0.067 inch thick.
8. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Exterior Color: Manufacturer's standard .
   b. Interior Color: Manufacturer's standard.
9. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.
   a. Sizes through 24 Inches Tall: Two hinges.
   b. Sizes between 24 Inches through 48 Inches Tall: Three hinges.
   c. Sizes Larger Than 48 Inches Tall: Four hinges.
10. Removable internal panel with white or gray polyester powder coating that is electrostatically applied and then baked to bond to substrate.
    a. Size Less Than 24 Inches: Solid or perforated steel, 0.053 inch thick.
    b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch or steel, 0.093 inch thick.
11. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
12. Grounding stud on enclosure body.
13. Thermoplastic pocket on inside of door for record Drawings and Product Data.

F. Accessories:

1. Bar handle with keyed cylinder lock set.

2.16 RELAYS

A. General-Purpose Relays:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. IDEC Corporation.
   b. Functional Devices.
2. NRTL listed.
3. Heavy-duty, electromechanical type; rated for at least 10 A at 250 V ac and 60 Hz.
4. SPDT, DPDT, or three-pole double-throw, as required by control application.
5. Plug-in-style relay with multiblade plug for DPDT relays and multiblade plug for three-pole double-throw relays.
6. Prepackaged relay with factory sealed housing.
7. Construct contacts of silver, silver alloy, or gold.
8. Enclose removable relay block in a clear transparent polycarbonate dust-tight cover.
9. If using factory enclosed relay, attach relay to exterior of enclosure or junction box using locking ring.
10. Clearly label all relays.
11. Include LED indication. If using prepacked relays, include manual rocker switch to allow local override.
12. Performance:
    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 5 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
13. Equip relays with coil transient suppression to limit transients to non-damaging levels.
14. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
15. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

2.17 ELECTRICAL POWER DEVICES

A. Control Transformers:

1. Control Transformers shall be Functional Devices PSH500A transformers with enclosures and covers. Each 100VA circuit shall serve a maximum of 5 VAVs and associated accessories.

2.18 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. Furnish local UPS units, of type indicated, installed with DDC system.

B. DIN Rail Mounted UPS:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. APC by Schneider Electric.
   b. Emerson Electric Co., Automation Solutions.
   c. Phoenix Contact.
2. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
3. Performance:
   a. Capacity: Load not to exceed 75 percent of rated capacity.
   b. Input Voltage: Single phase, 120 V ac, compatible with field power source.
   c. Load Power Factor Range (Crest Factor): 0.65 to 1.0 .
   d. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
   e. On Battery Output Voltage: Sine wave.
   f. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
   g. Battery Backup: Five minutes of operation at full load with battery power.
   h. Battery Recharge Time: Maximum of six hours to 90 percent capacity after full discharge.
   i. Transfer Time: 6 ms.
   j. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B.
4. Automatic bypass operation during fault or overload conditions.
5. Integral line-interactive, power condition topology to eliminate all power contaminants.
6. Include power switch and visual indication of power, battery, fault.
7. Include audible alarm of faults with silence feature.
8. Batteries: Sealed; maintenance free; replacement without dropping load.

2.19 PRESSURE INSTRUMENT SIGNAL AIR PIPING AND TUBING

A. Products in this article are intended for use with the following:

1. Signal air between pressure instruments, such as sensors, switches, transmitters, controllers, and accessories.

B. Polyethylene Tubing (Pressure Instrument Signal Air):

1. Fire-resistant, black virgin polyethylene in accordance with ASTM D1248, Type 1, Class C, and Grade 5.
2. Complying with stress crack test in accordance with ASTM D1693.
3. Diameter, as required by application, of not less than nominal 1/4 inch.
4. Polyethylene Tubing Connectors and Fittings - Brass, Barb Fittings:
   a. Tapered and beaded hose barbs of push-on design; intended for low-pressure applications only.

5. Polyethylene Tubing Connectors and Fittings - Brass, Compression Type:
   a. Specially designed for jointing polyethylene tubing to provide leak-free seal without twisting or weakening polyethylene tubing.

2.20 CONTROL WIRE AND CABLE

A. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Conductor Insulation Colors:
   a. Twisted Pair: Black and white.
   b. Twisted Triad: Black, red, and white.
5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
7. Furnish on spools.

B. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

2.21 WALL-MOUNTED THERMOSTATS

A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.Thermostats shall be Johnson Controls, Inc. Model number NSB8BHC040-0 combination Temperature/Relative Humidity/CO2 thermostat or equal.

B. Thermostats shall be installed with anti-tamper cover equal to Grainger Universal Cover 2E706, or equivalent cover to fit specified thermostat. Cover shall be locking type.

2.22 OCCUPANCY SENSORS

A. Ceiling mounted occupancy sensors shall be Watt Stopper CI-24 model. Occupancy sensors shall be placed in appropriate location according to manufacturers recommendations.

B. If a single VAV serves multiple discrete zones (such as non-connected offices), multiple occupancy sensors shall be installed in parallel such that any sensor may call associated VAV into occupied mode.

2.23 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:

1. Self-adhesive label Laminated acrylic or melamine plastic sign bearing unique identification.
    a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.
2. Letter size as follows:
    a. DDC Controllers: Minimum of 0.5 inch high.
    b. Gateways: Minimum of 0.5 inch high.
    c. Repeaters: Minimum of 0.5 inch high.
    d. Enclosures: Minimum of 0.5 inch high.
    e. Electrical Power Devices: Minimum of 0.25 inch high.
    f. UPS units: Minimum of 0.5 inch high.
    g. Accessories: Minimum of 0.25 inch high.
    h. Instruments: Minimum of 0.25 inch high.
    i. Control Damper and Valve Actuators: Minimum of 0.25 inch high.
3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded black with contrasting white center exposed by engraving through outer layer.
4. Fastened with drive pins.
5. Instruments, control devices, and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Valve Tags:

1. Brass tags and brass chains attached to valve.
2. Tag Size: Minimum 1.5 inches in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Equipment Warning Labels:

1. Self-adhesive label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size at least 14-point type with white lettering on red background.
3. Warning label to read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering to be enclosed in a white line border. Edge of label is to extend at least 0.25 inch beyond white border.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring, and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to force.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."

G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. Fastening Hardware:

1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

I. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.3 INSTALLATION OF SERVERS

A. Coordinate with HCPSS to add system to existing servers located at Central Maintenance Facility on Mendenhall Court.

B. Install software indicated on server(s) and verify that software functions properly.

C. Develop Project-specific graphics, trends, reports, logs, and historical database.

3.4 INSTALLATION OF GATEWAYS

A. Install gateways if required for DDC system communication interface requirements indicated.

1. Install gateway(s) required to suit indicated requirements.

B. Test gateways to verify that communication interface functions properly.

3.5 INSTALLATION OF ROUTERS

A. Install routers if required for DDC system communication interface requirements indicated.

1. Install router(s) required to suit indicated requirements.

B. Test routers to verify that communication interface functions properly.

3.6 INSTALLATION OF CONTROLLERS

A. Install controllers in enclosures to comply with indicated requirements.

B. Connect controllers to field power supply and UPS units..

C. Install controllers with latest version of applicable software and configure to execute requirements indicated.

D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.

E. Installation of Network Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of network controllers to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor.

F. Installation of Programmable Application Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of programmable application controllers to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor, except where dedicated controllers are installed at terminal units.

G. Application-Specific Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of application-specific controllers to satisfy requirements indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in a location that is easily accessible by operators.

3.7 INSTALLATION OF ENCLOSURES

A. Install the following items in enclosures, to comply with indicated requirements:

1. Gateways.
2. Routers.
3. Controllers.
4. Electrical power devices.
5. UPS units.
6. Relays.

B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 , Type 4, Type 12, and any other Enclosures: Use galvanized-steel strut and hardware.
2. For NEMA 250, Type 4 Enclosures and Enclosures Located Outdoors: Use stainless steel strut and hardware.
3. Install plastic caps on exposed cut edges of strut.

C. Align top or bottom of adjacent enclosures of like size.

D. For floor-mounted enclosures located in mechanical equipment rooms : attach enclosure legs using galvanized-steel or stainless steel anchors.

E. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireways used for application are to have protection equal to NEMA 250 rating of connected enclosures.

3.8 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade to provide a fully functioning DDC system. Work is to comply with NFPA 70 and other requirements indicated.

3.9 INSTALLATION OF IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install self-adhesive labelsorlaminated acrylic or melamine plastic signs with unique identification on face for each of the following:

1. Gateway.
2. Router.
3. DDC controller.
4. Enclosure.
5. Electrical power device.
6. UPS unit.

C. Install unique instrument identification for each instrument connected to DDC controller.

D. Install unique identification for each control damper and valve actuator connected to DDC controller.

E. Where product is installed above accessible tile ceiling, also install matching identification on face of ceiling grid located directly below.

F. Where product is installed above an inaccessible ceiling, also install identification on face of access door directly below.

G. Warning Labels and Signs:

1. Permanently attach to equipment that can be automatically started by DDC control system.
2. Locate where highly visible near power service entry points.

3.10 INSTALLATION OF NETWORKS

A. Install balanced twisted pair or CAT-6cable when connecting between the following network devices located in same building:

1. Operator workstations.
2. Operator workstations and network controllers.

3. Network controllers.
4. Network controllers and IT drops coordinated with HCPSS IT department. .

B. Install balanced twisted pair or copper cable (as required by equipment) when connecting between the following:

1. Gateways.
2. Gateways and network controllers or programmable application controllers.
3. Routers and network controllers or programmable application controllers.
4. Network controllers and programmable application controllers.
5. Programmable application controllers.
6. Programmable application controllers and application-specific controllers.
7. Application-specific controllers.
8. .

C. Install cable in continuous raceway.

1. Where indicated on Drawings, cable trays may be used for copper cable in lieu of conduit.

3.11 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

B. ASHRAE 135 Networks:

1. MAC Address:
   a. Assign and document a MAC address unique to its network for every network device.
   b. Ethernet Networks: Document MAC address assigned at its creation.
   c. MS/TP Networks: Assign from 00 to 64.
2. Network Numbering:
   a. Assign unique numbers to each new network.
   b. Provide ability for changing network number through device switches or operator interface.
   c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.
3. Device Object Identifier Property Number:
   a. Assign unique device object identifier property numbers or device instances for each device network.
   b. Provide for future modification of device instance number by device switches or operator interface.
   c. LAN is to support up to 4,194,302 unique devices.
4. Device Object Name Property Text:
   a. Device object name property field to support 32 minimum printable characters.
   b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.

1) Example 1: Device object name for device controlling heating water boiler plant at Building 1000 would be "Heating Water System Bldg. 1000."
2) Example 2: Device object name for VAV terminal unit controller could be "VAV Unit 102."

5. Object Name Property Text for Other Than Device Objects:
   a. Object name property field is to support 32 minimum printable characters.
   b. Assign object name properties with plain-English names descriptive of application.
      1) Example 1: "Zone 1 Temperature."
      2) Example 2 "Fan Start and Stop."
6. Object Identifier Property Number for Other Than Device Objects:
   a. Assign object identifier property numbers according to Drawings or tables indicated.
   b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented, and be unique for like object types within device.

3.12 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

A. Comply with NECA 1.

B. Wire and Cable Installation:

1. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
   a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
2. All wiring shall be secured in place. All adjustable securing methods (zip ties, hook-and-loop fasteners, etc.) shall be plenum-rated where required. Galvanized J-hooks shall be used to support wiring. No existing hangars for the drop ceiling, lighting, or other equipment shall be used as support.
3. Terminate wiring in a junction box.
   a. Clamp cable over jacket in a junction box.
   b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.
4. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
5. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
6. Use shielded cable to transmitters.
7. Use shielded cable to temperature sensors.
8. Perform continuity and meager testing on wire and cable after installation.

3.13 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

3.14 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

E. Control Damper Checkout:

1. Verify that control dampers are installed correctly for flow direction.
2. Verify that damper actuator and linkage attachment are secure.
3. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
4. Verify that damper blade travel is unobstructed.

F. Control Valve Checkout:

1. Verify that control valves are installed correctly for flow direction.
2. Verify that valve body attachment is properly secured and sealed.
3. Verify that valve actuator and linkage attachment are secure.
4. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
5. Verify that valve ball, disc, or plug travel is unobstructed.
6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace valve if leaks persist.

G. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments, verify the following:
   a. Sensing element type and proper material.
   b. Length and insertion.

3.15 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION, AND TESTING

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration to comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

1. Use field testing and diagnostic instruments and equipment with an accuracy at least twice the instrument accuracy of instrument to be calibrated. For example, test and calibrate an installed instrument with accuracy of 1 percent using field testing and diagnostic instrument with accuracy of 0.5 percent or better.

F. Calibrate each instrument in accordance with instruction manual supplied by instrument manufacturer.

G. If after calibration the indicated performance cannot be achieved, replace out-of-tolerance instruments.

H. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Controls Components," in the absence of specific requirements, and to supplement requirements indicated.

I. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

J. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

K. Control Dampers:

1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.

2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

L. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

M. Meters: Check meters at zero, 50, and 100 percent of Project design values.

N. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

O. Switches: Calibrate switches to make or break contact at set points indicated.

P. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.16 DDC SYSTEM CONTROLLER CHECKOUT

A. Verify power supply.

1. Verify voltage, phase, and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to backup power source.
6. If applicable, verify that power conditioning units are installed.

B. Verify that wire and cabling are properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.17 DDC CONTROLLER I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify that operation is stable and accurate.
4. Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:
   a. Upper quarter of range.
   b. Lower quarter of range.
   c. At midpoint of range.
8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller, and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller, and at field instrument must match.
10. Prepare and submit report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.18 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After review of Pretest Checklist and Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed Pretest Checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Using BACnet protocol analyzer, verify that communications are error free.
10. Each controller's programming is backed up.
11. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
12. All I/O points are programmed into controllers.

13. Testing, adjusting, and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power and loss of signal.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power and loss of signal.
18. Meter, sensor, and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphics are created.
26. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit validation Test Plan including test procedures for performance validation tests.
2. Address all specified functions of DDC system and sequences of operation in Test Plan.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include Test Checklist to be used to check and initial that each test has been successfully completed.
6. Submit Test Plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.
    a. Verify analog I/O points at operating value.
    b. Make adjustments to out-of-tolerance I/O points.
        1) Identify I/O points for future reference.
        2) Simulate abnormal conditions to demonstrate proper function of safety devices.
        3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.
2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. 24 hours after initial validation test, do as follows:
    a. Re-check I/O points that required corrections during initial test.
    b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.
5. 24 Hours after second validation test, do as follows:
    a. Re-check I/O points that required corrections during second test.

b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit report indicating results of testing. For all I/O points that required correction, indicate how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.19 FINAL REVIEW

A. Submit written request to Engineer and Owner when DDC system is ready for final review. State the following:

1. DDC system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Contractor shall work with the Construction Manager/Design Engineer to commission and demonstrate proper operation of 10% of all installed DDC components, up to 40 hours of work. If more than 10% of this selection is not found to be in compliance with the drawings and specifications, a subsequent visit shall be scheduled to demonstrate proper operation of 25% of all installed DDC components. Similarly, if more than 10% of this selection is not found to be in compliance with the drawings and specifications, all equipment is to be commissioned.

C. Upon receipt of written request for final review, Engineer andOwner and to start review within reasonable period and upon completion issue field report(s) documenting observations and deficiencies.

D. Take prompt action to remedy deficiencies indicated in reviewer's field report(s) and submit second written request after all deficiencies have been corrected. Repeat process until no deficiencies are reported.

E. Compensation for Subsequent Reviews: Should more than one review be required, DDC system manufacturer and Installer to compensate entity/entities performing reviews for total costs (labor and expenses) associated with subsequent reviews. Estimated cost of each subsequent review to be submitted and approved by DDC system manufacturer and Installer before review.

F. Prepare and submit closeout submittals when no deficiencies are reported.

G. Part of DDC system final review shall to include demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration to include, but not be limited to, the following:
    a. Accuracy and calibration of 10 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
    b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points to be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
    c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
    d. Operation of randomly selected dampers and valves in normal-on, normal-off, and failed positions.
    e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
    f. Trends, summaries, logs, and reports set up for Project.
    g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
    h. Software's ability to communicate with controllers, operator workstations, and uploading and downloading of control programs.
    i. Software's ability to edit control programs offline.
    j. Data entry to show Project-specific customizing capability including parameter changes.
    k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
    l. Execution of digital and analog commands in graphic mode.
    m. Spreadsheet and curve plot software and its integration with database.
    n. Online user guide and help functions.
    o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
    p. System speed of response compared to requirements indicated.
    q. For Each Network and Programmable Application Controller:
        1) Memory: Programmed data, parameters, trend, and alarm history collected during normal operation are not to be lost during power failure.
        2) Operator Interface: Ability to connect directly to each type of digital controller with portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.

3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
4) Electric Power: Ability to disconnect any controller safely from its power source.
5) Wiring Labels: Match control drawings.
6) Network Communication: Ability to locate controller's location on network and communication architecture matches Shop Drawings.
7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

r. For Each Operator Workstation:
1) I/O points lists agree with naming conventions.
2) Graphics are complete.
3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Requirements must be met even if only one manufacturer's equipment is installed.
1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set-Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:
a) Display of network device status.
b) Display of BACnet object information.
c) Silencing devices transmitting erroneous data.
d) Time synchronization.
e) Remote device re-initialization.

f) Backup and restore network device programming and master database(s).
g) Configuration management of routers.

3.20 EXTENDED OPERATION TEST

A. Operate DDC system for operating period of 14 consecutive calendar days following Substantial Completion. Coordinate exact start date of testing with Owner.

B. During operating period, DDC system to demonstrate correct operation and accuracy of monitored and controlled points as well as operation capabilities of sequences, logs, trends, reports, specialized control algorithms, diagnostics, and other software indicated.

1. Correct defects of hardware and software when they occur.

C. Definition of Failures and Downtime during Operating Period:

1. Failed I/O point constituting downtime is I/O point failing to perform its intended function consistently and a point physically failed due to hardware and software.
2. Downtime is when any I/O point in DDC system is unable to fulfill its required function.
3. Calculate downtime as elapsed time between detected point failure as confirmed by operator, and time point is restored to service.
4. Maximum time interval allowed between DDC system detection of failure occurrence and operator confirmation is to be 0.5 hours.
5. Log downtime in hours to nearest 0.1 hour.
6. Power outages do not count as downtime, but do suspend test hours unless systems are provided with UPS and served through a backup power source.
7. Hardware or software failures caused by power outages do count as downtime.

D. During operating period, log downtime and operational problems are encountered.

1. Identify source of problem.
2. Provide written description of corrective action taken.
3. Record duration of downtime.
4. Maintain log showing the following:
   a. Time of occurrence.
   b. Description of each occurrence and pertinent written comments for reviewer to understand scope and extent of occurrence.
   c. Downtime for each failed I/O point.
   d. Running total of downtime and total time of I/O point after each problem has been restored.
5. Make log available to Owner for review at any time.

E. For DDC system to pass extended operation test, total downtime is limited to 2 percent of total point-hours during operating period.

1. If DDC system testing results fail to comply with minimum requirements of passing at end of operating period indicated, extend operating period one consecutive day at a time until DDC system passes requirement.

F. Base evaluation of DDC system passing test on the following calculation:

1. Count downtime on point-hour basis where total number of DDC system point-hours is equal to total number of I/O points in DDC system multiplied by total number of hours during operating period.
2. One point-hour of downtime is one I/O point down for one hour. For example, three I/O points down for five hours is total of 15 point-hours of downtime. Four points down for one-half hour is two point-hours of downtime.
3. Example Calculation: Maximum allowable downtime for 30-day test for DDC system with 1000 total I/O points (combined analog and binary) and passing score of 1 percent downtime is computed by 30 days x 24 h/day x 1000 points x 1 percent equals 7200 point-hours of maximum allowable downtime.

G. Prepare test and inspection reports.

3.21 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.22 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, verify that maintenance service includes 12 months' full maintenance by DDC system manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration, and adjusting as required for proper operation. Use only manufacturer's authorized replacement parts and supplies.

3.23 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, verify that service agreement includes software support for two year(s).

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two year(s) from date of Substantial Completion. Verify that upgrading software includes operating system and new or revised licenses for using software.

1. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

3.24 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:
   a. Provide not less than four hours of training total.

C. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm, and each unique optimization routine.
5. Operating operator workstations, printers, and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports, and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.
14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
16. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
17. Executing digital and analog commands in graphic mode.
18. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.
19. Demonstrating DDC system performance through trend logs and command tracing.
20. Demonstrating scan, update, and alarm responsiveness.
21. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.

END OF SECTION 230923

SECTION 260160 - BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract, including General and Supplementary condition and General Requirements, and Division 01 specifications apply to the work specified in specifications of Division 26.

B. This section includes general administrative and procedural requirements for electrical installations. The administrative and procedural requirements such as Submittal, Operating and Maintenance Manuals, Handling and storage of equipment, etc. are included in this section to expand the requirements specified in Division 01.

1.2 SCOPE

A. The work of all sections of Division 26 includes furnishing and installing the material, equipment and systems complete as specified therein and indicated on drawings. The electrical installation when finished shall be complete and coordinated, whole and ready for satisfactory use.

B. Specifications are intended to include everything necessary for a first class installation. If mention has been omitted herein of any items of the work or materials usually furnished for, or necessary, for the complete installation of electrical work or if there are conflicting points in the specifications and/or drawings, the attention of the Owner or their representative should be called to such items in sufficient time for a formal addendum to be issued. Any and all conflicting points in the specifications and/or drawings which are not questioned by the Contractor and clarified by a formal addendum prior to opening of bids shall be subject to the interpretation of the Owner or their designated representative after award of the contract and his/her interpretation shall be binding upon the Contractor.

C. All materials and equipment shall be installed and completed in a first-class and workmanlike manner and in accordance with the best modern methods and practices. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance, or are not installed in accordance with these specifications, or the contract drawings, shall be removed and replaced when so directed in writing by the Owner or their designated representative at the Contractor's expense.

D. Should the Contractor discover any discrepancies between actual conditions and those indicated pertaining to the existing work which may prevent following good practice or the intent of the drawings and specifications, the Contractor shall notify the construction manager and shall not proceed with the work until instructions have been received from the Owner or their designated representative.

E. The Contractor shall furnish and install all labor, materials, equipment, tools, and services necessary for and reasonably incidental to furnishing and completing the

installation of all electrical work, including the installation of conduits, wires, boxes, devices, equipment, etc. as shown on the contract drawings and/or called for in the specifications, and deliver it to the Owner in proper working condition.

F. It is intended that the specifications and drawings include everything requisite and necessary to complete the entire work properly, notwithstanding the fact that every item involved may not be specifically mentioned.

G. The specifications outlines, in general manner, the work required to be performed by the Contractor. The Contractor is responsible for work which may be reasonably interpreted from the specifications and/or drawings as necessary for a complete installation ready for service. The words "install" and/or "installation" shall be interpreted as the inclusion of the following work:
   1. Setting, plumbing, aligning, and anchoring of equipment on foundations.
   2. Placing all mounting bolts, base channels, cable clamps and supports.
   3. Mounting and connecting of electrical items shipped separately and removing and replacing equipment parts to facilitate handling.
   4. Making internal connections on equipment which were omitted for shipment. Provision of jumpers and local temporary interconnections that may not be listed in the cable tabulations at no additional cost to the Owner.
   5. Cleaning and checking of electrical equipment and connections.
   6. Repair to damaged surfaces and equipment shall be made to the satisfaction of the construction manager at no additional cost to the Owner.

H. The Contractor shall protect work in progress from physical damage and against the intrusion of dirt. The work area shall be kept clear of debris to prevent interference with other operations. The Contractor will be solely responsible for all refuse, debris, and trash attributable to this work. Removal shall be in accordance with all applicable ordinances and the Contractor shall pay any and all fees associated with the disposal of rubbish.

I. Suitable warning and/or protection shall be provided around temporary openings, handholes, open trenches, removed sections of gratings, or other hazardous areas and conditions.

1.3 RESPONSIBILITY

A. The General Contractor shall be responsible for all work included in Division 26 and the delegation of work to subcontractors shall not relieve him of his responsibility. The term "contractor" is used throughout this Division and shall mean the General Contractor, although the actual performance of the work may be by a Subcontractor.

B. The Contractor shall carefully examine all plans, specifications, and documents. After careful examination of all documents, the Contractor shall visit the construction site and thoroughly acquaint himself with the conditions under which the work will be executed. Lack of knowledge and the items which could have been discovered or detected at the time of field visit will not be considered acceptable for extra work compensation.

1.4 REFERENCES AND DEFINITIONS

A. The following are definitions of the terms and expressions used in Division 26 Sections:

Construction Manager:	Owner's designated representative
Provide:	"furnish and install"
Directed:	"directed by the Engineer or Owner"
Indicated:	"Indicated in contract drawings"
Concealed:	"hidden from normal sight; includes items in shafts, duct spaces (chases), and above ceilings.
Exposed:	"not concealed"

B. Listed: Equipment or device is listed of a kind mentioned which:
1. Is published by a nationally recognized laboratory which makes periodic inspections of production of such equipment.
2. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

C. Labeled: Equipment or device is labeled when:
1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
2. The laboratory makes periodic inspections of the production of such equipment.
3. The labeling indicates compliance with nationally recognized standards or tests to determine the safe use in a specified manner.

D. Certified: Equipment or product is certified which:
1. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
2. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
3. Bears a label, tag or other record of certification.

E. Nationally recognized testing laboratory: Is a company, which is approved, in accordance with OSHA regulations, by the Secretary of Labor, Federal Government.

1.5 CODES, REGULATIONS AND PERMITS

A. Give all necessary notices and obtain all required permits. Pay all fees and other costs, including utility connections in connection with the work. File all necessary plans, prepare all documents and obtain all necessary permits and approvals from all governmental agencies having jurisdiction. Obtain all required certificates of inspection and deliver same to the construction manager before request for acceptance and payment for the work.

B. All materials furnished, and all work installed, shall comply with the latest editions in effect at the time and date of invitation of bids, of codes, standards, rules and regulations and recommendations of the bodies, such as:
1. American National Standards Institute (ANSI)
2. American Society of Testing and Materials (ASTM)
3. Insulated Cable Engineer Association (ICEA)

4. National Electrical Code (NEC) – 2011 Edition
5. National Electrical Manufacturers Association (NEMA)
6. National Fire Protection Association (NFPA)
7. Occupational Safety and Health Agency (OSHA)
8. Underwriters Laboratories, Inc. (UL)
9. National Electrical Safety Code (NESC)
10. Institute of Electrical and Electronics Engineers (IEEE)
11. International Building Code (IBC)
12. American Disability Act (ADA)

C. Drawings and specifications shall govern in those instances, where the requirements indicated on the construction documents are greater than the requirements required by applicable codes and other standards, rules and regulations.

1.6 SUBMITTALS

A. See Section 010000 “General Requirements.”

1.7 WARRANTY

A. All material and equipment provided under this division shall be free from defects in workmanship and materials for a period of two years after date of certification of completion and acceptance of work. All defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the Contractor on notice from the Owner or their designated representative, without cost to the Owner. In default thereof, Owner may have such work done by others and charge the cost of same to the Contractor.

1.8 SITE VISIT

A. Prior to preparing the bid, the Contractor shall visit the site and familiarize himself with existing conditions, make necessary investigations as to locations of existing equipment, utilities, etc. and all other matters which can affect work under the contract. No additional compensation will be paid to the Contractor as a result of his failure to completely familiarize himself with the existing conditions (under which the work must be performed), which could have been discovered at the site visit.

B. See Instructions to Bidders.

1.9 DRAWINGS

A. The drawings are diagrammatic and are intended to indicate general arrangement and manner of connections. They are not intended to show all details of construction or exact locations of the work. The exact final location of all electrical items shall be approved by the Engineer and Owner before installation.

B. The Contractor shall carefully examine all contract documents and shall be responsible for the proper fitting of all materials and equipment.

C. Although the location of materials and equipment may be shown on the drawings in a certain place, the construction may develop conditions that render this location inaccessible or impractical. The Contractor shall call the condition to the attention of the Owner or their designated representative for his direction, before fabricating and installing the work. When requested by the Owner or their designated representative, a detailed drawing of the proposed departure due to field conditions or their causes shall be submitted by the Contractor for approval. The Owner, or their designated representative, shall make all final written decisions as to the conditions which require the changing of any work.

D. A reasonable shifting in the locations of outlets and/or equipment before installation is expected and shall be done at no increased cost to the Owner.

E. IT is the intention and requirement of the specification that proper service be provided to and for all pieces of equipment requiring the same. As far as possible, the proper service to each piece of equipment has been indicated on the plans. The Contractor shall verify the service requirements of all pieces of equipment before making final provisions. Shop drawings shall be obtained for check before installation. The Contractor shall also check the exact point of connection so that service for each piece of equipment may be brought to the proper location.

1.10 TEMPORARY POWER FOR CONSTRUCTION AND LIGHT

A. The Contractor shall provide temporary power for construction and power (If and where needed). All costs associated with temporary power, such as permits, fees, etc. shall be paid by Contractor. Temporary wiring shall be maintained by Contractor in a safe operating condition for all areas where work is in progress.

B. All temporary work shall be in accordance with the latest OSHA, State of Maryland and local authorities having jurisdiction safety requirements and shall be completely removed upon completion of the project.

C. Permanent building power wiring and equipment can be used as temporary power for construction power and light, with the written approval from University.

1.11 ELECTRICAL SYMBOLS

A. Electrical equipment indicated on plans by symbols shall be taken to mean a complete installed device, including all items as may be required by the NEC or any other code or standard referenced and made a part of herein.

PART 2 GENERAL

2.1 RELATED DOCUMENTS

A. All electrical materials and equipment shall be new, shall carry a UL label when such material, equipment, and/or systems are of a type or class listed by UL and shall be suitable for the conditions and duties imposed on them. If a UL label is not available from the manufacturer when requested by owner and/or required by authorities having jurisdiction, then the equipment shall be tested by an approved electrical testing company in accordance with NEC, at no additional charge to the

Owner. Submit data indicating compliance with standards prior to installation. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the specifications.

B. All component parts of each item of equipment or device shall bear the manufacturer's name plate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor shall not be acceptable.

C. In specifying materials, three general procedures are used. The three classifications are as follows:
   1. Group 1: When the material or equipment is specified by name or other identifying information and one name brand only is used, it is considered that the use of that particular item is essential to the project and the Contractor shall base his proposal on the cost of that item. Where any item of material or equipment is specified by proprietary name, trade name or manufacturer, it is understood that the item named, is intended to be used.
   2. Group 2: When the material or equipment is specified with the phrase "or approved equal." after a brand name and other identifying information, it is intended that the brand name used is for the purpose of establishing a minimum acceptable standard of quality and performance and the Contractor may base his bid proposal on any item which is in all respects equal or better to that specified and presents essentially the same appearance, size, operation, performance, and will fit in the available space.
   3. Group 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, ANSI, ASTM, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects with the referred "Standard Specification".

D. It is distinctly understood:
   1. that the Owner or their designated representative will use his own judgement in determining whether or not any materials, equipment or methods offered for approval as an equal are equal to those specified and will fit the space available.
   2. that the decision of the architect/engineer on all such question of equality is final
   3. all acceptable material, equipment or methods will be provided at no increase in cost to the Owner

E. Upon receipt of written notice from the Owner or their designated representative that the material, equipment or methods have been reviewed and accepted (no exceptions taken or comments as noted), the Contractor may proceed with the accepted equal material, equipment or methods, providing the Contractor assumes full responsibility for and performs any change or adjustment in construction, such as clearances in accordance with NEC, Article 110 and/or as recommended by equipment manufacturer, that may be required by the use of such materials, equipment or methods, including services provided under other divisions at the Contractor's expense.

F. In the event of adverse decisions by the Owner of their designated representative, no claim of any sort shall be made or allowed against the Architect or the Engineer or the Owner.

2.2 INSTALLATION

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate electrical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for concrete pads, chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of electrical systems with exterior underground services. Comply with requirements of governing regulations, utility companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements refer conflict to the Engineer and Owner.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
   10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
   11. Install access panel or doors where units are concealed behind finished surfaces.
   12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

2.3 EQUIPMENT SUPPORTS, FOUNDATIONS AND STANDS

A. The Contractor shall provide all supports, foundations and stands required for the electrical equipment and shall provide, align and set all necessary anchor bolts.

B. Where equipment is indicated or specified to be floor mounted stands shall be constructed of structural steel sections (or steel pipe and fittings braced and fastened with flanges) bolted to the floor.

C. Concrete pads shall be not less than four inches high unless otherwise indicated on drawings and shall extend minimum four (4) to six (6) inches beyond the equipment base on all sides. Exposed edges and corners shall be chamfered and exposed surfaces shall be finished smooth.

D. All conduit penetrations through floor slabs or other fire rated walls shall be complete with fire seals as manufactured by OZ Gedney "Fire Stop" or equal UL approved.

2.4 NAMEPLATES AND LABELS

A. All panelboards, disconnect switches, starters, VFDs, unit enclosed circuit breakers, control equipment, and instrumentation, etc. shall be provided with engraved laminated black and white phenolic nameplates with beveled trim. Data and installation shall be approved by Owner or his designated representative. Nameplate lettering shall be minimum 1/8" high etched letters. All nameplates shall be fastened with screws without altering the NEMA classification of the enclosure.

B. All wiring in junction boxes, pull boxes, etc shall be identified as to point of origin and termination. Tagging of such circuits shall be permanent. Paper or tape tags are not acceptable.

PART 3 EXECUTION

3.1 COORDINATION OF WORK

A. The Contractor shall have a competent foreman on the premises at all times to check, layout, and superintend the installation of the work shown on the drawings and described in these specifications. He shall provide information regarding location and sizes of chases and openings and shall be responsible for the accuracy of such information. The foreman at site shall supervise and layout the installation of all hangers, inserts, sleeves and other work in masonry and concrete in advance of and during construction, giving consideration to the work of other trades to prevent interference in the location of other equipment.

B. Exact locations of electrical equipment, underground raceway conduits, panels, starters, disconnect switches, etc. and other electrical work shall be coordinated with all other trades and there will be no interference between the trades. Where conflicts result, they shall be resolved by the Contractor to the satisfaction of the Owner or their designated representative at no expense to the Owner.

3.2 WORKMANSHIP

A. Workmanship shall be of the highest quality obtainable in the trade working with the materials specified. Workmanship shall be satisfactory to the Owner or his designated representative and his decision as to acceptable quality is final.

B. All work shall be performed by skilled electricians and mechanics in the trades involved.

3.3 OVERTIME

A. Any work required to be performed at other than normal working hours (nights, holidays, weekends, etc.) shall be taken into consideration by the Contractor when computing the bids. Extra compensation shall not be allowed to the Contractor for any work performed at other than normal working hours.

3.4 HANDLING AND STORAGE OF MATERIALS

A. Paper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment or materials, so that no equipment or materials are damaged.

B. All electrical material and equipment delivered to the job site shall be under roof or other approved covering, on pedestals above ground. All enclosures for equipment shall be weatherproof.

C. The Contractor shall be held accountable for all material and equipment received by him as evidenced by the list prepared by the Contractor and in the event of loss or disappearance of or damage to any such material or equipment, the Contractor shall replace such items without additional cost to the Owner.

D. Storing and maintaining materials and equipment after receipt until the completed installation is accepted by the Owner. Such storage and maintenance shall be in accordance with the manufacturer's recommendations and the requirements of these specifications. The Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance and shall recondition, repair, or replace any such deteriorated materials or equipment without additional cost to the Owner.
   1. Electrical conduit shall be stored so as to provide protection from the weather and accidental damage. Plastic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat.
   2. Cables shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather.

E. Materials and equipment which are found to be defective or damaged as a result of improper handling and or storage, shall be subject to removal, at the direction of the Owner or his designated representative and replaced with new materials and equipment with no additional cost to the Owner.

3.5 EQUIPMENT CONNECTIONS

A. All equipment requiring electrical service shall be installed and connected in accordance with the latest codes, contract documents, the best engineering practices and in accordance with manufacturer's recommendations.

B. Equipment connections indicated on drawings shall be considered diagrammatic. The actual connections shall be made to best suit the requirements of each case and to minimize the space used.

C. All conduits, outlets, wiring and all necessary fittings or accessories for connections to all electrical equipment shall be provided. All equipment ratings shown on the drawings are for the specified equipment. Should equipment of different ratings be furnished, all circuit components shall be adjusted accordingly, at the Contractor's expense, after approval by the Owner or his designed representative. The Contractor shall be responsible for confirming the proper size and location of each equipment connection before fabrication and installation of work.

3.6 WATERPROOFING

A. All waterproofing and damp-proofing of the building shall be held unharmed by the installation of work under this division. Wherever any of the work or conduits under this division penetrate waterproofing and damp-proofing, including outside walls, such penetrations shall be made only when approved by the Owner or their designated representative and the pierced surface shall be made watertight. Any waterproofing damaged or destroyed shall be replaced at the Contractor's expense.

3.7 CUTTING, PATCHING AND PAINTING

A. All cutting, patching and painting necessary for the installation of the electrical work shall be done under Division 02. Any damage done to work already in place shall be redone at the Contractor's expense. Patching shall be uniform in appearance and shall match surrounding surfaces. Painting, wherever required, shall match existing paint.

B. All exposed equipment, including conduit installed under this Division, shall be cleaned and left in a condition ready for painting. All items not provided with a corrosion-resistant finish shall be painted. Unless otherwise directed by owner, all electrical panels, control equipment, and supporting framework, except as indicated otherwise, shall have a light gray enamel finish which may be the manufacturer's standard gray, if acceptable to Owner. Where the finish becomes scratched or marred, it shall be touched up or repainted to match the original finish as directed by the construction manager. Particular caution shall be exercised so as not to obscure the nameplate.

3.8 SLEEVES AND PLATES

A. Sleeves shall be provided by the Contractor for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction.

B. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, construction. Caulk the annular space of sleeves with an elastic fire resistant caulking compound to make installation fire, air and watertight.

C. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into space between conduits, etc. and sleeve during construction.

D. At all sleeves where objectionable noise can be transmitted, at smoke barriers, at walls above ceilings that extend to underside of the structure of floor above, or at fire rated separations, seal all openings between conduit, etc. and corresponding sleeves to prevent sound transmission and to maintain fire rating. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval. Where watertight sleeves are indicated or required to suite the installation, provide Link Seal rubber seals as manufactured by Thunderline Corporation, between pipe and sleeves.

E. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suite conditions.

3.9 GROUNDING

A. The entire electrical installation shall be grounded in accordance with Article 250 of the National Electrical Code, National Electrical Safety Code, IEEE recommendations, and Underwriters Laboratories, Inc., latest editions.

3.10 TESTING AND INSPECTIONS

A. Low Voltage Testing (600 Volt Or Less)
   1. Upon completion of the work, the contractor shall in the presence of the owner and engineer, operate, test, adjust, and retest if necessary, the complete electrical systems. All systems shall function fully and complete as intended in design, and are ready to be occupied.
   2. The contractor shall furnish all labor, materials, supplies, equipment, instruments, and power necessary for measurements, testing and settings as required. The measurement, testing and setting shall demonstrate:
      a. That all the lighting, power, and control circuits are continuous and free from short circuits and other defects.
      b. That all the circuits are free from unspecified grounds
      c. That all circuits and equipment are properly connected in accordance with applicable wiring diagrams and are operable by demonstrating the functioning of each control device not less than ten (10) times and by continuous operation of each circuit for not less than one half hour.
      d. Any other testing required under other section of Division 26 work.
      e. Make tests of each motor provided under Mechanical Division to measure the actual service parameters while the motor is operating at design duty conditions, including steady state full load amperes (FLA), voltage and power factor.
      f. Results of the above tests shall show the all the equipment and wiring meets the requirements of these specifications before being accepted by the engineer and owner. Should any of the above tests indicate defects in materials or workmanship, the faculty installation shall be repaired or replaced at once and the tests be re-conducted at contractor’s expense.
      g. Operational Tests: the contractor shall note that certain other sections of these specifications require tests of the operation of various items of equipment. He shall familiarize himself with these requirements and where electrical controls are involved, in any of these tests, he shall furnish any

services or materials required to make any electrical performance tests required.

3. All defects shall be repaired at once and tests re-conducted at contractor's expense.
4. For the purpose of these tests, normal and emergency conditions may be simulated during these tests if approved by the Engineer. The services of the manufacturer's factory trained service engineer shall be provided to inspect the installation of all equipment furnished under this division to assure that is installed in accordance with the manufacturer's instructions, assist with start up and instruct operating personnel in the operation and maintenance of the equipment.

B. Inspection
1. All phases of the work shall be inspected by a testing/inspection agency (Third party inspection), as specified in each section of the specifications.
2. An electrical certificate from the County inspection agency must be submitted to the owner prior to or with the final payment invoice. The electrical sub-contractor shall file with county permit department and pay all fees associated with such filing, at the start of construction so that adequate rough-in inspections can be made during the course of work.
3. Submit all inspection reports within 7 days from the inspection, specifically for all feeder installations, all panelboards, starters etc.

3.11 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.
1. Conduct tests in presence of Owner or his Representative and, if required, inspectors of agencies having jurisdiction.
2. Arrange date of tests in advance with Owner, manufacturer and installer.
3. Give all inspectors minimum of one week notice.
4. Furnish all labor and materials required for period of test.

B. Repair or replace equipment and systems found inoperative or defective and retest.
1. If equipment or system fails retest, replace it with products which conform with Contract Documents.
2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

D. Coordinate work of this section with work of other sections to insure timely delivery and installation of work.

3.12 ADJUST AND CLEAN (SEE DIVISION 01)

A. Inspect all equipment and put in good working order. Clean all exposed and concealed items.

END OF SECTION 260160

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Common electrical installation requirements.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. EPDM: Ethylene-propylene-diene monomer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
   5. Design sufficient access and working space for repair and maintenance about all electrical equipment to permit ready and safe operation and maintenance of such equipment, as per OSHA 29 CFR 1910 Subpart D and 1910.303(g).

B. Coordinate installation of required supporting devices and set sleeves in the existing cast-in-place concrete, masonry walls, and other existing structural components.

C. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 078413 "Penetration Firestopping."

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Stainless steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, etc. penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 078413 "Penetration Firestopping."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches above finished floor level.

I. Size pipe and sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth,

and location of joint. Refer to Section 079200 "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Section 078413 "Penetration Firestopping."

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 078413 "Penetration Firestopping."

3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene monomer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports: From a qualified testing and inspection agency engaged by the contractor.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Owner, and marked for intended use.

C. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Southwire Company
2. General Cable Corporation.

B. Copper Conductors: Comply with NEMA WC 70. Aluminum conductors are not acceptable.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN rated at 90 degrees C.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

G. Class 2 Control Circuits: Type THHN-THWN, in raceway.

H. MC Cable: MC Cable not allowed for this project.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. All wiring will be provided in the exposed raceways, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed raceways with cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

G. No MC Cables allowed for this project.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors. No aluminum allowed.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Refer to Section 260500.

3.6 SLEEVE-SEAL INSTALLATION

A. Refer to Section 260500.

3.7 FIRESTOPPING

A. Refer to Section 078413 “Penetration Firestopping.”

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor to engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the Inter National Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
4. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) cross section, unless otherwise indicated; with insulators

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
Pipe Connectors: Clamp type, sized for pipe.

2.3 GROUNDING ELECTRODES

Grounding rods shall be copper-clad steel, ¾ inch in diameter by 10 feet long

PART 3 EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated, such as scene shop.

1. Install bus on insulated spacers 2 inches minimum from wall and 6 inches above finished floor, unless otherwise. Also refer to telecommunication drawings for ground bus locations.

2. Where indicated on both sides of doorway, route bus up to top of door frame, across top of doorway, and down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Ground Rod Connections: Install exothermic weld connection.
4. Connections to Ground Rods at Test Wells: Bolted connectors.
5. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

C. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

F. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

G. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.

B. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

C. Test completed grounding system at each location where a maximum ground-resistance level is specified. Report measured ground resistances that exceed the following values:

   1. Power and Lighting Equipment or System: 5 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner and Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA−4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA−4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA−4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        (1) Hilti Inc.
        (2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        (3) MKT Fastening, LLC.
        (4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        (1) Cooper B-Line, Inc.; a division of Cooper Industries.
        (2) Empire Tool and Manufacturing Co., Inc.
        (3) Hilti Inc.
        (4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        (5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 for steel shapes and plates.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated from slotted steel support system, sized to enable capacity to be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

THIS PAGE LEFT BLANK

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquid-tight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube & Conduit; a Tyco International Ltd. Co.
   4. Anamet Electrical, Inc.; Anaconda Metal Hose.
   5. Electri-Flex Co.
   6. O-Z Gedney; a unit of General Signal.
   7. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquid-tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Fittings for EMT: Compression type. Screw type not accepted.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. EGS/Appleton Electric.
   3. Erickson Electrical Equipment Company.
   4. Hoffman.
   5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
   6. RACO; a Hubbell Company.
   7. Thomas & Betts Corporation.
   8. Walker Systems, Inc.; Wiremold Company (The).
   9. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed (used and located only 8 feet above finished floor) and not Subject to Physical Damage: EMT.
   2. Exposed (used and located within 8 feet above finished floor) and Subject to Severe Physical Damage: Rigid steel conduit
      a. Mechanical rooms: EMT may be used in the mechanical rooms when located 8 feet above floor level provided that is not subject to physical damage such as near operable valve handles etc. In such cases where the raceways are subject to physical damage even above 8 feet above finished floor, such raceways shall be galvanized rigid steel raceways. All raceways within 8 feet shall be rigid steel conduits.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   4. Damp or Wet Locations and all outdoor locations: Galvanized Rigid steel conduit.
   5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

B. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

D. Do not install aluminum conduits. Aluminum raceways are not acceptable.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

H. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

I. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

J. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC damp or wet locations not subject to severe physical damage.

K. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Refer to Section 260500.

3.4 SLEEVE-SEAL INSTALLATION

A. Refer to Section 260500.

3.5 FIRESTOPPING

A. Refer to Section 078413 “Penetration Firestopping.”

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

THIS PAGE LEFT BLANK

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Identification for raceway and metal-clad cable.
   2. Identification for conductors and communication and control cable.
   3. Warning labels and signs.
   4. Instruction signs.
   5. Equipment identification labels.
   6. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:
   1. Power Circuits: Black letters on an orange field.
   2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

C. Stenciled Legend: In nonfading, waterproof black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

1. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
   a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
      (1) Primer: Interior concrete and masonry primer.
      (2) Finish Coats: Interior semigloss alkyd enamel.
2. Interior Concrete Unit Masonry:
   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
      (1) Block Filler: Concrete unit masonry block filler.
      (2) Finish Coats: Interior semigloss acrylic enamel.
3. Interior Gypsum Board:
   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      (1) Primer: Interior gypsum board primer.
      (2) Finish Coats: Interior semigloss acrylic enamel.
4. Interior Ferrous Metal:
   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      (1) Primer: Interior ferrous-metal primer.
      (2) Finish Coats: Interior semigloss acrylic enamel.
5. Interior Zinc-Coated Metal (except Raceways):
   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      (1) Primer: Interior zinc-coated metal primer.
      (2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl tape applied in bands.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.

3. Mechanical and Electrical Supervisory System: Green and blue.
4. Telecommunication System: Green and yellow.
5. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in pull- and junction-boxes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels with metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

H. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal,

monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled for engraved laminated acrylic tags:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Automatic Transfer Switches
   c. Panelboards
   d. Disconnect switches.
   e. Enclosed circuit breakers.
   f. Motor starters.
   g. Variable Frequency Drives

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

E. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG
2. Colors for Circuits:

	208/120 volt circuits	480/277 volt circuits
a.	Phase A: Black.	Brown
b.	Phase B: Red.	Orange
c.	Phase C: Blue.	Yellow

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 260553

SECTION 260810 - INSPECTIONS, TESTING AND START-UP

PART 1 GENERAL

1.1 DESCRIPTION

A. The intent of the inspection, testing, and check-out work specified herein is to insure that all electrical workmanship and equipment, whether Owner furnished or Contractor furnished, is installed and performs in accordance with the Contract Documents, manufacturer's instructions and all applicable codes and requirements. Also, it is intended to insure the following:

1. Equipment has not been subjected to damage during shipment or installation.
2. Equipment is in accordance with the specifications.
3. A bench mark is established for routine maintenance and troubleshooting.
4. Successful start-up without last minute interruptions and delays.
5. Each system component is installed satisfactorily and will perform its function reliably throughout the life of the plant.

B. Testing requirements in other sections of this Specification are intended to compliment and not supersede nor be superseded by this Section.

1.2 RELATED SECTIONS

A. Section 013300 for Submittal Procedures.

B. Division 26 - Electrical Specifications.

1.3 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI C2, National Electrical Safety Code
2. ANSI Z244-1, American National Standard for Personnel Protection

B. American Society of Testing and Materials (ASTM)

C. Institute of Electrical and Electronic Engineers (IEEE)

D. Insulated Cable Engineers Association (ICEA)

E. International Electrical Testing Association (NETA)

F. National Electrical Manufacturer’s Association (NEMA)

G. National Fire Protection Association (NFPA)

1. ANSI/NFPA 70, National Electrical Code
2. ANSI/NFPA 70B, Electrical Equipment Maintenance
3. ANSI/NFPA 70E, Standard for Electrical Safety in the Workplace

H. Occupational Safety and Health Administration (OSHA)

I. State and Local Codes and Ordinances

1.4 SUBMITTALS

A. Provide resumes for personnel conducting tests and evidence of the testing firm's qualifications, accreditation and experience.

B. Provide a list of test equipment to be utilized including the manufacturer’s name, model number, serial number, accuracy, and last date of calibration.

C. Provide industry standards or guide specifications used in lieu of National Standards.

D. Provide testing procedures and schedules.

1.5 TESTING FIRM

A. The testing firm shall be a competent, independent electrical equipment testing laboratory or organization. The testing firm shall not be a subsidiary, division, nor a department of either the installing Contractor or the manufacturer of the equipment materials or systems being inspected and tested. The testing firm shall be a fully accredited member of the International Electrical Testing Association (NETA) and have the specialized experience and skill in the supervision and performance of all inspection and testing specified herein.

1.6 TEST INSTRUMENT CALIBRATION

A. The testing firm shall have a calibration program which assures that all applicable test instrumentation is maintained within rated accuracy.

B. The accuracy shall be directly traceable to the National Bureau of Standards.

C. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field instruments, analog: six (6) months.
2. Field instruments, digital: twelve (12) months.
3. Laboratory instruments: 12 months.
4. Leased specialty equipment: 12 months.

D. Calibration labels shall be visible on all equipment and shall have a date of calibration and due date. Calibration records shall be available for review by the Owner.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 COORDINATION

A. Provide all necessary supervision and labor, materials, tools, test instruments and other equipment or services required to inspect, test, adjust, set, calibrate, functionally and operationally check all work and equipment.

B. Provide a set of contract documents to the testing firm providing the tests.

C. Provide the testing firm a set of approved submittals and shop drawings for the equipment to be tested by the testing firm.

D. Prepare procedures and schedules for all inspections, tests, settings and calibrations specified or otherwise required. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks. All procedures submitted shall include proposed job safety rules.

E. Provide a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements. The Owner shall approve all sources of electrical power for testing.

F. Notify the Owner prior to the commencement of any testing.

3.2 INSPECTIONS AND TESTS

A. Equipment purchased by the Contractor or purchased by the Owner but installed by the Contractor shall be inspected and tested to determine its condition.

B. The inspections, tests and checks described herein shall not be considered as complete and all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests shall be provided as necessary throughout the project, prior to final acceptance by the Owner.

C. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, faulty, or requiring repairs shall be reported to the Owner. Corrective action may require prior approval.

D. Perform routine insulation resistance, continuity and phase rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

E. The testing firm shall provide visual and mechanical inspections of the following systems and equipment.

1. Panelboards
2. Low voltage wiring (600 volt and below)
3. Molded case circuit breakers rated less than 400 amperes
4. Motor controls & Controllers
5. Variable Frequency Controllers
6. Disconnect switches.

F. The rotation of all motors shall be checked and corrective action shall be taken where necessary to obtain correct rotation.

G. Engagement of the testing firm in no way relieves the Contractor of the responsibility for the performance of the many and varied tests, checkouts, and inspections required during the various stages of construction.

3.3 CERTIFICATION

A. Provide certified test reports. Test reports shall meet the criteria specified in OSHA Regulation Part 1907, “Accreditation of Testing Laboratories”. The certification shall attest to the fact that the electrical installation has been installed and tested in accordance with the applicable National Standards or, where no National Standard exists, the applicable industry standard or guide specification for the equipment involved.

B. The following information shall be included in the test reports.

1. Description of equipment tested (manufacturer, model number, serial number).
2. Description of test and standards used.
3. Description of test equipment.
4. Test results with pass/fail criteria.
5. Conclusions and recommendations.
6. Names of personnel conducting the test.

C. The report shall be signed by a Registered Professional Engineer.

D. Provide three (3) copies of the complete test report no later than fifteen (15) calendar days following completion of the tests.

END OF SECTION 260810

SECTION 262923 - VARIABLE-FREQUENCY MOTOR DRIVES (VFD)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes separately enclosed, preassembled, combination variable frequency motor controllers (VFDs), rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. All drives shall be provided (furnished and installed) by Division 16.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. DDC: Direct digital control.

C. EMI: Electromagnetic interference.

D. LED: Light-emitting diode.

E. NC: Normally closed.

F. NO: Normally open.

G. OCPD: Overcurrent protective device.

H. PID: Control action, proportional plus integral plus derivative.

I. RFI: Radio-frequency interference.

1.4 QUALITY ASSURANCE

A. Referenced Standards and Guidelines:

1. Institute of Electrical and Electronic Engineers (IEEE)

a. IEEE 519-2014, IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems

2. Underwriters Laboratories (as appropriate)

    a. UL 508, 508A, 508C
    b. UL 61800, 61800-5-1, 61800-5-2
    c. UL 1995

3. The Association of Electrical Equipment and Medical Imaging Manufacturers (NEMA)
4. NEMA ICS 7-2014, Adjustable Speed Drives

    a. International Electro-technical Commission (IEC)
    b. EN/IEC 61800

5. National Electric Code (NEC)

    a. NEC 430.120, Adjustable-Speed Drive Systems

6. CSA Group

    a. CSA C22.2 No. 274

7. International Building Code (IBC)

    a. IBC 2018 Seismic – referencing ASCE 7-16 and ICC AC-156

B. Qualifications:

1. Drives shall be UL labeled as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR when installed in accordance with the manufacturer's guidelines.

2. CE Mark – The base drive shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The base drive shall meet product standard EN 61800-3 for the First Environment restricted distribution (Category C2).

3. The base drive shall be seismically certified and labeled as such in accordance with the 2018 International Building Code (IBC):

    a. Seismic importance factor of 1.5, and minimum 2.5 SDS rating is required.

    b. Ratings shall be based upon actual shake test data as defined by ICC AC-156, via all three axis of motion.

    c. Seismic certification of equipment and components shall be provided by OSHPD preapproval.

4. The base drive shall be SEMI-F47 certified. The drive must tolerate voltage sags to 50% for up to 0.2 seconds, sags to 70% for up to 0.5 seconds, and sags to 80% for up to one second.

1.5 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFD indicated.

1. Include dimensions and finishes for VFDs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Drive horsepower shall be minimum size as indicated. Coordinate size with driven equipment manufacturer based on rated motor horsepower and full load amps (FLA).
4. Provide all accessories as integral components to the drive assembly unless noted otherwise on the drive schedule. Entire assembly shall be UL listed and meet NEC. Bypass panels shall be constructed of UL recognized components, assembled in a UL listed enclosure in strict accordance with the NEC for electrical safety. The assembly shall be UL listed.

B. Shop Drawings: For each VFD indicated.

1. Include mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearance, methods of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Required working clearances and required area above and around VFDs.
2. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements.
3. Show support locations, type of support, and weight on each support.
4. Indicate field measurements.

B. Qualification Data: For testing agency.

C. Product Certificates: For each VFD from manufacturer.

D. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519-2014, Guide for Harmonic Content and Control.

1. List all drives
2. Provide simplified one-line diagram indicating Point of Common Coupling (PCC) or approved Harmonic Analysis program with technical description of all inputs and outputs from programs

E. Source quality-control.

1. Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2.

    a. Test each VFD while connected to its specified motor.
    b. Verification of Performance: Rate VFDs according to operation of functions and features specified.

2. VFDs will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

F. Field quality-control reports.

G. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFDs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
    b. Manufacturer's written instructions for setting field-adjustable overload relays.
    c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
    e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
    f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.8 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller. Contractor may provide temporary electric service for drives with integral heaters in lieu of temporary heating,

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFDs, including clearances between VFDs, and adjacent surfaces and other items.

1.9 WARRANTY

A. When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

B. Special Warranty: Sixty (60) months from date of shipment. Provide certificate from the Manufacturer. Warranty shall include all parts, labor, travel time and expenses. Prorating is not acceptable. Manufacturer certificate shall provide name(s) of warranty providers who can perform onsite warranty service. Local Warranty, Parts, and Maintenance service shall be available within a 2-hour travel time and on record at Manufacturer's toll free 24/365 technical support line. Third party warranty will not be acceptable. Manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.

B. Manufacturers: Subject to compliance with requirements, provide one of the following:

1. ABB ACH580 Series (Basis of Design)

2. Eaton

C. Submit deviations to owner for approval 10 days prior to bid. Approval does not relieve supplier of specification requirements.

D. All VFDs shall be of the same manufacturer.

2.2 GENERAL

A. VFDs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A.

C. VFDs supplied to Owner or Owner's Representative, either as separate items to be mounted in the field or shipped to an OEM for factory mounting in packaged systems. The drive manufacturer shall supply the drive and all necessary options as herein specified.

D. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.

1. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a “brand labeled” drive.

E. Application: Variable Torque

F. VFD Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Poly-phase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

G. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection. Sizing based on ratings in equipment schedules.

H. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Full rated output at +10% and -15% percent of VFD input voltage rating. VFD shall continue to operate without faulting from a line of +30% and -35% of nominal voltage.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: 48 to 63 Hz
4. Minimum Efficiency: 98 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
6. Minimum Short-Circuit Current (SCCR) Rating:

    a. Standard: 100 kA
    b. Drives with soft start: 85kA
    c. Drives with individual motor protectors: 50kA

7. Ambient Conditions: VFDs shall be capable of continuous full load operation under the following environmental conditions:

    a. Temperature: Not less than 5 deg F and not exceeding 104 deg F. Operation up to 122 deg F shall be allowed with a 10% reduction from VFD full load current
    b. Humidity: 5 to 95% (non-condensing).

c. Altitude: 0 - 3300 feet. Operation up to 6600 feet above sea level shall be allowed with a 1% reduction from VFD full load current rating for every 330 feet over 3300 feet above sea level.

8. Vibration Withstand: Comply with ISTA 1A and 1B.
9. Overload Capability: 110% of normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum current rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors. Output Carrier Frequency: Selectable; 1, 2, 4, 8 (12 kHz w/ derate)

I. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.

J. The input current rating of the drive shall not be greater than the output current rating. Per NFPA 70 430.122, drives with higher input current ratings may require the upstream wiring, protection devices, and source transformers to be upsized.

2.3 SEISMIC PERFORMANCE:

A. The entire VFD assembly shall be seismically certified and labeled as such in accordance with the 2018 International Building Code (IBC):

B. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.

C. Seismic importance factor of 1.5 rating is required and shall be based upon actual shake test data as defined by ICC AC-156.

D. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.

E. Special seismic certification of equipment and components shall be provided by OSHPD preapproval.

2.4 ENCLOSURES

A. VFD Enclosures: Enclosures shall be UL508, listed as a complete assembly from the factory or shall be evaluated in the field by a Nationally Recognized Testing Laboratory (NRTL) under a field evaluation program.

B. Enclosure type shall be provided as indicated on the contract documents. If no requirements are listed, provide enclosures according to environmental conditions at installed location as indicated below:

1. Dry and Clean Indoor Locations: UL Type (NEMA) 1.
2. Outdoor Locations: UL Type (NEMA) 3R.
3. Outdoor Corrosive Locations: UL Type (NEMA) 3R Stainless Steel Construction
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL Type (NEMA) 12.

C. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFD as "Plenum Rated."

D. For NEMA 250, Type 1; UL 508 component recognized: Supply fan, with composite intake and exhaust grills and filters; 120-V ac; obtained from integral CPT.

E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.5 INTEGRAL DISCONNECT

A. As indicated on the contract documents, provide one of the integral disconnect options below:

1. Circuit Breaker - Door interlocked pad-lockable circuit breaker that will disconnect all input power from the drive and all internally mounted options. Circuit breaker option shall be available with or without systems requiring bypass.

2. Disconnect Switch with Fuses - Door interlocked, pad-lockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Drive input fusing is included.

B. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Disconnect packages manufactured by anyone other than the drive manufacturer, are not acceptable.

2.6 PANEL-MOUNTED USER INTERFACE KEYPAD

A. All drives shall utilize the same Advanced Control Panel (keypad) user interface.

B. Plain English text

1. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable).
2. Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.
3. Safety interlock, run permissive, and external fault status shall have the option of additional customized project specific terms, such as: AHU-1 End Switch, Office Smoke Alarm, CT-2 Vibration.

C. The control panel shall include at minimum the followings controls:
1. Four navigation keys (Up, Down, Left, Right) and two soft keys to simplify operation and programming.
2. Hand-Off-Auto selections and manual speed control without having to navigate to a parameter.
3. Fault Reset and Help keys. The Help key shall include assistance for programming and troubleshooting.

D. Multiple Home View screens shall be capable of displaying up to 21 points of information. Customizable modules shall include bar charts, graphs, meters, and data lists. Displays shall provide real time graphical trending of output power, frequency, and current within selectable intervals of 15/30/60 minutes and 24 hours.

E. The control panel shall display the following items on a single screen; output frequency, output current, reference signal, drive name, time, and operating mode (Hand vs Auto, Run vs Stop). Bi-color (red/green) status LED shall be included. Drive (equipment) name shall be customizable.

F. There shall be a built-in time clock in the control panel. The clock shall have a battery backup with 10 years minimum life span. Daylight savings time shall be selectable.

G. I/O Summary display with a single screen shall indicate and provide:
   1. The status/values of all analog inputs, analog outputs, digital inputs, and relay outputs. Drives that require access to internal or live components to measure these values, are not acceptable.
   2. The programmed function of all analog inputs, analog outputs, digital inputs, and relay outputs.
   3. The ability to force individual digital I/O high or low and individual analog I/O to desired value, for increased personal protection during drive commissioning and troubleshooting. Drives that require access to internal or live components to perform these functions, are not acceptable.

H. The drive shall automatically backup parameters to the control panel. In addition to the automatic backup, the drive shall allow two additional unique backup parameter sets to be stored. Backup files shall include a time and date stamp. In the event of a drive failure, the control panel of the original drive can be installed on the replacement drive, and parameters from that control panel can be downloaded into the replacement drive.

I. The control panel shall display local technical support contact information as part of drive fault status.

J. The control panel shall be removable, capable of remote mounting.

K. The control panel shall have the ability to store screen shots that are downloadable via USB.

L. The control panel shall have the ability to display a QR code for quick access to drive information.

M. The LCD screen shall be backlit with the ability to adjust the screen brightness and contrast, with inverted contrast mode. A user-selectable timer shall dim the display and save power when not in use.

N. The control panel shall include assistants specifically designed to facilitate start-up. Assistants shall include: First Start Assistant, Basic Operation, Basic Control, and PID Assistant.

O. Primary settings for HVAC shall provide quick set-up of all parameters and customer interfaces to reduce programming time.

P. The drive shall be able to operate with the control panel removed.

Q. Bluetooth connectivity:

1. Where indicated on the project documents, the drive shall be provided a Bluetooth Advanced Control Panel. The Bluetooth control panel shall be FCC and QDL (Qualified Design Listing) certified.
2. A free app (iOS and Android) shall replicate the control panel on a mobile device or tablet. The control panel's programming and control functionality shall function on the device. Customizing text, such as AHU-1 End Switch, shall be supported by the device's keyboard.
3. Bluetooth connectivity shall allow uploading, downloading, and emailing of parameter sets.
4. Bluetooth connectivity shall include two pairing modes: Always discoverable with a fixed pass code, and manual discovery with a unique generated passcode every pairing.
5. The Bluetooth antenna shall be in the control panel. Antennas that are integrated in the drive's control board, must include an external antenna, on all drives mounted inside cabinets.
6. Bluetooth connectivity shall be capable of being switched off.

2.7 SECURITY FEATURES

A. The drive manufacture shall clearly define cybersecurity capabilities for their products.

B. The drive shall include password protection against parameter changes.

1. There shall be multiple levels of password protection including: End User, Service, Advanced, and Override.
2. The drive shall support a customer generated unique password between 0 and 99,999,999.
3. The drive shall log an event whenever the drive password has been entered.
4. The drive shall provide a security selection that prevents any "back door" entry. This selection even prevents the drive manufacturer from being able to bypass the security of that drive.
5. A security level shall be available that prevents the drive from being flashed with new firmware.

C. A checksum feature shall be used to notify the owner of unauthorized parameter changes made to the drive. The checksum feature includes two unique values assigned to a specific programming configuration.

1. One checksum value shall represent all user editable parameters in the drive except communication setup parameters. A second checksum value shall represent all user editable parameters except communication setup, energy, and motor data parameters.
2. Once the drive has been commissioned the two values can be independently saved in the drive.

3. The drive shall be configurable to either: Log an Event, provide a Warning, or Fault upon a parameter change when the current checksum value does not equal the saved checksum value.

D. The “Hand” and “Off” control panel buttons shall have the option to be individually disabled (via parameter) for drives mounted in public areas.

E. The capability to disable Bluetooth on control panels that include Bluetooth functionality shall be provided.

2.8 NETWORK COMMUNICATIONS

A. The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways are not acceptable.

B. The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming.

C. The drive shall not require a power cycle after communication parameters have been updated.

D. The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later. Use of non-BTL Listed drives are not acceptable.

E. The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

1. Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B
2. Device Management: Time Synchronization-B
3. Object Type Support: MSV, Loop

F. The drive’s relay output status, digital input status, analog input/output values, Hand-Auto status, warning and fault information shall be capable of being monitored over the network. The drive’s start/stop command, speed reference command, relay outputs and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.

2.9 SOFTWARE FEATURES:

A. A Fault Logger that stores the last 16 faults in non-volatile memory.

1. The most recent 5 faults save at least 9 data points, including but not limited to: Time/date, frequency, DC bus voltage, motor current, DI status, temperature, and status words.
2. The date and time of each fault and fault reset attempt shall be stored in the Fault Logger.

B. An Event Logger that stores the last 16 warnings or events that occurred, in non-volatile memory.

1. Events shall include, but not limited to: Warning messages, checksum mismatch, run permissive open, start interlock open, and automatic reset of a fault.
2. The date and time of each event's start and completion points shall be stored in the Event Logger.

C. Programmable start method. Start method shall be selectable based on the application: Flying-start, Normal-start, and Brake-on-start.

D. Programmable loss-of-load (broken belt / coupling) indication. Indication shall be selectable as a control panel warning, relay output, or over network communications. This function to include a programmable time delay to eliminate false loss-of-load indications.

E. Motor heating function to prevent condensation build up in the motor. Motor heating adjustment, via parameter, shall be in "Watts." Heating functions based only on "percent current" are not acceptable.

F. Advanced power metering abilities shall be included in the drive. Drives without these data points, must include a separate power meter with each drive.

1. Instantaneous output power (kW)
2. Total power broken down by kWh, MWh, and GWh units of measurement. Power meters that only display kWh and roll over or "max out" once the maximum kWh value is reached, are not acceptable. There shall be resettable and non-resettable total power meters within the drive.
3. Time based kWh metering for: current hour, previous hour, current day, and previous day.
4. Energy saving calculation shall be included that shows the energy and dollars saved by the drive.

G. The drive shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.

H. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command, the Drives shall provide a dry contact closure that will signal the damper to open. When the damper is fully open, an end-switch shall close, allowing the drive to run the motor.

1. The drive shall also include a programmable start delay, for when an end-switch is not provided.

I. Start interlock circuit - Four separate start interlock (safety) inputs shall be provided. When any safety is opened, the motor shall be commanded to stop. The control panel will display the specific safety(s) that are open. The status of each safety shall be transmitted over the network communications. Wiring multiple safeties in series is not acceptable.

J. External fault circuit – Three separate external fault inputs shall be provided. This circuit shall have the same features and functionality as the start interlock circuit, except it shall require a manual reset before the drive is allowed to operate the motor.

K. The drive shall include a switching frequency control circuit that reduces the switching frequency based on actual drive temperature, and allows higher switching frequency settings without derating the drive. It shall be possible to set a minimum and a target switching frequency.

L. Visual function block adaptive programming allowing custom control schemes, minimizing the need for external controllers. I.e. cooling tower staging logic. A free software tool shall be used to configure adaptive programming.

M. The ability to automatically restart after an over-current, over-voltage, under-voltage, external fault, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable. Each of these faults may have automatic restart individually disabled via a parameter selection.

N. Three (3) programmable critical frequency lockout ranges to prevent the drive from operating the load continuously at an unstable speed/load.

O. Seven (7) programmable preset frequencies/speeds.

P. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

Q. PID functionality shall be included in the drive.

1. Programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped based on the level of a process feedback signal.
2. The drive shall include an independent PID loop for customer use, assigned to an analog output. This PID loop may be used for cooling tower bypass valve control, chilled water valve, etc.

R. At least 4 parameter user sets that can be saved to the permanent memory and recalled using a digital input, timed function, or supervision function.

S. Drive shall be compatible with an accessory that allows the control board to be powered from an external 24 VDC/VAC source, allowing the drive control to remain powered by a UPS during an extended power outage.

T. A computer-based software tool shall be available to allow a laptop to program the drive. The drive shall be able to support programming without the need for line voltage. All necessary power shall be sourced via the laptop USB port.

U. The drive shall include a fireman's override mode. Upon receipt of a contact closure from the Fire Alarm Life Safety system, the drive shall operate in a dedicated Override mode distinct and separate from the drive's Normal operation mode. The following features will be available in the drive override function:

1. The Override mode shall be secured by password to prevent changes once programmed.
2. The drive shall ignore external inputs and commands not defined as part of the override function.
3. Override operation mode shall be selectable between: single frequency, multiple fixed frequencies, follow an analog input signal, PID control, or come to a forced stop.
4. High priority safeties shall stop the drive and lower priority safeties shall be ignored in Override mode.
5. Drive faults shall be defined in Critical and Low priority groups. Critical faults shall stop the drive. Low priority faults shall be reset. Reset trials and timing shall be programmable.
6. The drive shall be configurable to receive from 1 to 3 discrete digital input signals and operate at up to three discrete speeds.

V. The drive shall have multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped with drives. The drive shall have a parameter synchronization feature to program the PID, multi-pump, and AI parameters in all parallel drives. The functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly.

W. The multi-pump functionality shall control:

1. Flow Control
2. Pressure Control
3. Pump Alternation

2.10 HARDWARE FEATURE

A. Electric Input Signal Interface:

1. A minimum of two programmable analog inputs: 0- to 10-V dc or 4- to 20-mA selectable via control panel.
2. A minimum of six programmable digital inputs: All digital inputs shall be programmable to support both active high and active low logic and shall include adjustable on/off time delays. The digital input shall be capable of accepting both 24 VDC and 24 VAC.
3. A minimum of two programmable analog outputs: 0- to 10-V dc or 4- to 20-mA.
4. A minimum of three programmable Form-C relay outputs. The relay outputs shall include programmable on/off time delays. The relays shall be rated for a continuous current rating of 2 Amps. Maximum switching voltage of 250 VAC / 30 VDC. Open collector and Form-A relays are not acceptable. Drives that have less than (3) Form-C relay outputs shall provide an option card to provide additional relay outputs.

B. Drive terminal blocks shall be color coded for easy identification of function.

C. The drive shall include an isolated USB port for interface between the drive and a laptop. A non-isolated USB port is not acceptable.

D. An auxiliary power supply rated at 24 VDC, 250 mA shall be included.

E. The drive shall have cooling fans that are designed for field replacement. The primary cooling fan shall operate only when required and be variable speed for increased longevity and lower noise levels. Drives whose primary cooling fans are not variable speed, shall include a spare cooling fan.

F. Circuit boards shall be coated per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

G. Earth (ground) fault detection shall function in both modulating (running) and non-modulating modes.

H. Coordinated AC transient surge protection system consisting of 4 MOVs (phase-to-phase and phase-to-ground), a capacitor clamp, and internal chokes. The MOVs shall comply with UL 1449 4th Edition. Drives that do not include coordinated AC transient surge protection shall include an external TVSS/SPD (Transient Voltage Surge Suppressor/Surge Protection Device).

I. The drive shall include a robust DC bus to provide short term power-loss ride through. The DC bus Joule to drive kVA ratio shall be 4.5 J/kVA or higher. An inertia-based ride through function should help maintain the DC bus voltage during power loss events. Drives with control power ride through only, are not acceptable.

J. Drives serving multiple motors (i.e. fan arrays) shall contain individual manual motor protectors (MMP) for all motors served by drive. MMPs shall be sized based on the rated motor amperage. Refer to mechanical schedules for quantity and horsepower of motors.

    a. Provide MMP Common fault output
    b. Provide MMP status pilot lights on VFD enclosure.

2.11 HARMONIC CONDITIONING AND LINE FILTERING

A. Input Line Conditioning:

1. Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519-2014 recommendations.

2. At a minimum, the drives shall have internal impedance equivalent to 5% to reduce the harmonics to the power line. 5% impedance may be from dual (positive and negative DC link) chokes, or AC line reactor. Drives with only one DC link choke shall add an AC line reactor integral to the drive enclosure.

3. Provide additional harmonic filtration mitigation devices or as required to meet IEEE 519-2014. Acceptable additional harmonic filtration devices include:

    a. Integral AC Line Reactors
    b. Integral passive harmonic filters
    c. Active front End:

        1) An IGBT based active front end shall be used for mitigation of low frequency harmonics. A LCL filter shall be installed in front of the IGBTs to remove high frequency harmonics.
        2) Limit the current distortion to 3% total harmonic current distortion, when measured at the lugs of the drive.
        3) The drive shall provide full motor nameplate voltage while operating the motor at nameplate RPM. The output IGBTs must be modulating and in control of the motor during this 100% speed/load operating condition. The specified 3% current distortion and 1.0 displacement power factor shall be achievable during this operating condition.
        4) The hardware structure of the front end shall boost the DC bus voltage by 10% during low line conditions.
        5) Displacement power factor shall be 1.0 throughout the speed range.

    d. 12 pulse or 18 pulse PWM design

B. Output Filtering: Provide dV/dT output filters on load side of drive for motor protection where length exceeds motor manufacturer recommendations or 100 feet, whichever is smaller.

C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for First Environment restricted level (Category C2) with up to 100 feet of motor cable.

2.12 BYPASS SYSTEMS

A. Provide single enclosure containing a variable frequency drive and bypass system. All VFD with bypass configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Bypasses manufactured by anyone other than the drive manufacturer, are not acceptable.

B. Description: Complete factory wired and tested bypass system consisting of a door interlocked, pad-lockable disconnecting device, output contactor, bypass contactor, and fast acting VFD isolation fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.

C. Bypass Configuration: Two-contactor-style (bypass and output) bypass allowing motor operation via the power converter or the bypass controller; with input isolating switch arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

    1. Bypass Contactor: Load-break, IEC-rated contactor.

    2. Output Isolating Contactor: Non-load-break, IEC-rated contactor.

3. Drive Isolation Fuses: Fast acting fuses shall be provided to disconnect the VFD from the line prior to clearing upstream branch circuit protection to maintain bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor “isolation contactors” are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.

4. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode.

5. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35% to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Single-phase power supplies and control power transformers (CPT) are not acceptable.

D. Bypass Type

1. Less than 75 horsepower: Full-voltage (across-the-line) non-reversing.
2. 75 horsepower and above: Reduced voltage soft start.

E. Bypass Controller:

1. Bypass Mode shall be field-selectable Automatic or Manual to allow local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.

2. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Manual and Automatic modes even if the VFD has been removed from the system for repair / replacement.

3. Motor protection from single phase power conditions: The bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.

4. Bypass shall include Six (6) digital inputs and five (5) Form-C relay outputs. The digital inputs shall be capable of accepting both 24 VDC and 24 VAC. The bypass control board shall include an auxiliary power supply rated 24 VDC, 250 mA.

5. Network communications – the bypass shall include BACnet MS/TP, Modbus, and Johnson Controls N2 as standard. The bypass BACnet implementation shall be BTL Listed to Revision 14 or later. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, Ethernet/IP, Modbus TCP, and DeviceNet shall be available. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.

a. The bypass relay output status, digital input status, warning and fault information can be monitored over the network. Status information shall be monitored, including; operating mode (drive vs bypass), current drawn in bypass mode, broken belt, and phase-to-phase voltage. The bypass start/stop command, force to bypass command, and relay outputs shall be capable of being controlled over the network.

F. All bypass packages shall utilize a dedicated LCD bypass control panel (keypad) user interface. The bypass control panel must be a separate display from the drive control panel. Bypass packages that use a single shared drive/bypass control panel are not acceptable, due to that control panel acting as a single point of failure.

1. The bypass shall include a two-line, 20-character LCD display. The display shall allow the user to access parameters and view:

a. Bypass input voltage, current (Amps) and power (kW)
b. Bypass faults, warnings, and fault logs
c. Bypass operating time and energy consumption (resettable)

2. The bypass control panel shall include the following controls:

a. Four navigation keys (Up, Down, Enter, Escape)
b. Bypass Hand-Off-Auto, Drive mode / Bypass mode selectors, Bypass fault reset

3. The following indicating lights (LED PTT type) or control panel display indications shall be provided.

a. Drive mode selected, Bypass mode selected
b. Drive running, Bypass running
c. Drive fault, Bypass fault

4. Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.

G. All bypasses shall have the following software features as standard:

1. Programmable loss-of-load (broken belt / coupling) indication shall be functional in drive and bypass mode.

2. The bypass shall also support run permissive and start interlock control functionality, including start delay, as previously specified in the drive section.

3. The bypass control shall monitor the status of the drive and bypass contactors and indicate when there is a welded contactor contact or open contactor coil.

4. The bypass shall include a selection for either manual or automatic transfer to bypass. The automatic transfer mode shall allow the user to select the specific drive fault types that result in an automatic transfer to bypass. The automatic transfer mode shall not allow a transfer to bypass on motor related faults.

Automatic transfer schemes that do not differentiate between fault types, are not acceptable.

5. The bypass shall include the ability to select the operating mode of the system (Drive/Bypass) from either the bypass control panel or digital input.

6. The bypass shall include a supervisory control mode that monitors the value of the drive's analog input (feedback). This feedback value is used to control the bypass contactor on/off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.

7. Selectable Class 10, 20, or 30 electronic motor overload protection shall be included in both drive and bypass mode.

8. The drive and bypass shall be designed to operate as an integrated system when in Override mode. Whether operating in drive or bypass mode, the low priority safeties will be ignored, and high priority safeties will be followed. External start/stop commands will be ignored. There shall be four selectable Override modes:

    a. Bypass only, with two smoke control modes:

        1) Fixed pre-configuration of digital inputs
        2) Configurable high/low priority safeties and faults, to allow configuration to meet needs of local Authority Having Jurisdiction.

    b. Drive only
    c. Drive then transfer to bypass, in the event of a drive fault
    d. Force to Stop

H. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

2.13 REDUNDANT DRIVE ENCLOSURE

A. Where indicated on the contract documents, provide single drive enclosure containing two variable frequency drives of the horsepower indicated on mechanical schedules.

B. Enclosure cover shall be provided with:

1. External lead drive selector switch
2. Auto/off/manual selector switch
3. Drive run and fault lights for each individual drive
4. External fault light.
5. Individual drive control panels (keypads) shall be accessible without opening enclosure door.

C. Drives within enclosure shall be individually fused for uninterrupted operation. Drive shall automatically switch from lead drive to redundant drive upon a lead drive fault.

D. Isolating Switch: Each drive shall be equipped with a non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while the other drive is operating.

E. Drive shall be provided with a customer terminal block to allow single point connection for external building automation system and fire alarm system safety interlocks.

1. Provide ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP in the resident memory.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFDs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 16 Section for Hangers and Supports."

B. Floor-Mounting Controllers: Install VFDs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in other Divisions."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch VFD.

E. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 POWER WIRING INSTALLATION

A. Install Type TC-ER shielded cable from variable-frequency controller to related motor.

3.4 CONTROL WIRING INSTALLATION

A. Bundle, train, and support wiring in enclosures.

B. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.5 IDENTIFICATION

A. Identify VFDs, components, and control wiring. Comply with requirements for identification specified in other Division 16 Section

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFD with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify the Authority before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable pressure switches.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFDs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Authority's maintenance personnel to adjust, operate, reprogram, and maintain VFDs.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing Agency Qualifications: Member Company of NETA or an NRTL.

2. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing. Provide factory authorized technician to certify VFD's for full manufacturer's warranty.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify the Authority before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFD. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFD 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFDs will be considered defective if they do not pass tests and inspections.

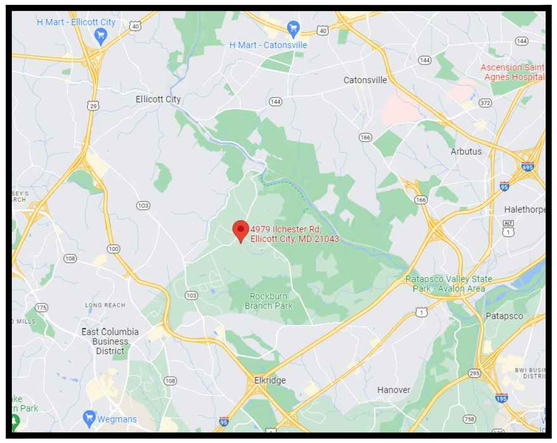
G. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

END OF SECTION 262923

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE

4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

HCPSS BID #100.23.B3



VICINITY MAP

100% CONSTRUCTION DOCUMENTS
MARCH 31, 2023

DRAWING LIST

GENERAL

T0.1	TITLE SHEET

MECHANICAL

M0.1	MECHANICAL ABBREVIATIONS, SYMBOLS & GENERAL NOTES
M2.1	MAIN LEVEL FLOOR PLAN - AREA A - HVAC
M2.2	MAIN LEVEL FLOOR PLAN - AREA B - HVAC
M2.3	LOWER LEVEL FLOOR PLAN - HVAC
M3.1	MECHANICAL SCHEDULES & DETAILS
M5.1	CONTROLS & SEQUENCE OF OPERATIONS
M5.2	CONTROLS & SEQUENCE OF OPERATIONS
M5.3	CONTROLS & SEQUENCE OF OPERATIONS
M5.4	CONTROLS, SEQUENCE OF OPERATIONS & NETWORK WIRING SCHEMATIC

ELECTRICAL

E0.1	ELECTRICAL LEGEND & GENERAL NOTES
E2.1	MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL DEMOLITION WORK
E2.2	MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL NEW WORK
E3.1	ELECTRICAL SCHEDULES

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building DYNAMICS
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

TITLE SHEET

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	AS SHOWN

SHEET

T0.1

ABBREVIATIONS

A	A	AMPERE(S)
	AC	ALTERNATING CURRENT
	ACT	ACOUSTICAL CEILING TILE
	AD	ACCESS DOOR
	AFF	ABOVE FINISHED FLOOR
	AFM	AIRFLOW MONITORING STATION
	AMB	AMBIENT
	AP	ACCESS PANEL
	APD	AIR PRESSURE DROP
	APPROX	APPROXIMATELY
	AS	AIR SEPARATOR
	ATC	AUTOMATIC TEMPERATURE CONTROLS
	ATM	ATMOSPHERE
	AUX	AUXILIARY
	AVG	AVERAGE
	AWG	AMERICAN WIRE GAUGE
	AWS	AMERICAN WELDING SOCIETY
B	BAS	BUILDING AUTOMATION SYSTEM
	BF	BELOW FLOOR
	BG	BELOW GRADE
	BHP	BRAKE HORSEPOWER
	BLDG	BUILDING
	BOB	BOTTOM OF BEAM
	BOP	BOTTOM OF PIPE
	BTUH	BRITISH THERMAL UNIT/HOUR
	BWEF	BAKED WHITE ENAMEL FINISH
C	C	CONDUIT
	C	COMMON
	°C	DEGREE CELSIUS
	CCTV	CLOSED CIRCUIT TELEVISION
	CB	CIRCUIT BREAKER
	CFH	CUBIC FEET PER HOUR
	CFM	CUBIC FEET PER MINUTE
	CKT	CIRCUIT
	℄	CENTERLINE
	CMPR	COMPRESSOR
	COND	CONDENSATE
	CONN	CONNECTION
	CONST	CONSTRUCTION
	COP	COEFFICIENT OF PERFORMANCE
	CTR	CENTER
	CU FT	CUBIC FEET
	CU IN	CUBIC INCH
	CX	CONNECT TO EXISTING
D	DB	DECIBEL(S)
	DBT	DRY BULB TEMPERATURE
	DC	DIRECT CURRENT
	DDC	DIRECT DIGITAL CONTROL
	DEG	DEGREE(S)
	DF	DROP FRAME
	DIA	DIAMETER
	DIS	DISCHARGE
	DN	DOWN
	DP	DEEP OR DEPTH
	DPT	DEWPOINT TEMPERATURE
	DWDI	DOUBLE WIDTH DOUBLE INLET
	DWG	DRAWING
	DX	DIRECT EXPANSION
E	EX	EXISTING
	EA	EACH
	EAT	ENTERING AIR TEMPERATURE
	EC	EMPTY CONDUIT
	EER	ENERGY EFFICIENCY RATIO
	EFF	EFFICIENCY
	EGU	EMERGENCY GENERATOR UNIT
	EL	ELEVATION
	ELEC	ELECTRIC
	ELEV	ELEVATOR
	EM	EMERGENCY
	EMS	ENERGY MANAGEMENT SYSTEM
	EMT	ELECTRICAL METALLIC TUBING
	EQ	EQUAL
	EQUIP	EQUIPMENT
	ESP	EXTERNAL STATIC PRESSURE
	EW	EACH WAY
	EWC	ELECTRIC WATER COOLER
	EWT	ENTERING WATER TEMPERATURE
	EXH	EXHAUST
	EXP	EXPANSION
	EXT	EXTERNAL
F	°F	DEGREE FAHRENHEIT
	FA	FROM ABOVE
	FACP	FIRE ALARM CONTROL PANEL
	FCU	FAN COIL UNIT
	FD	FLOOR DRAIN
	FDC	FIRE DEPARTMENT CONNECTION
	FDV	FIRE DEPARTMENT VALVE
	FE	FIRE EXTINGUISHER
	FEC	FIRE EXTIGUISHER CABINET
	FH	FIRE HYDRANT
	FHC	FIRE HOSE CABINET
	FHR	FIRE HOSE RACK
	FIN	FINISH
	FL	FLOOR
	FLG	FLANGED
	FLA	FULL LOAD AMPERE(S)
	FLEX	FLEXIBLE
	FO	FLAT OVAL
	FOB	FLAT ON BOTTOM
	FOT	FLAT ON TOP
	FP	FIRE PROTECTION
	FPM	FEET PER MINUTE
	FPS	FEET PER SECOND
	FT	FEET
	FTB	FLOOR TO BOTTOM
	FTC	FLOOR TO CENTERLINE
	FTR	FINNED TUBE RADIATION
	FV	FACE VELOCITY
	FVNR	FULL VOLTAGE NON-REVERSING
	FXC	FLEXIBLE CONNECTION
G	G	GUIDE(S)
	GA	GAUGE
	GAL	GALLON(S)
	GALV	GALVANIZED
	GFCI	GROUND FAULT CIRCUIT INTERRUPTER
	GM	GAS METER
	GND	GROUND
	GPH	GALLONS PER HOUR
	GPM	GALLONS PER MINUTE
	GSM	GALVANIZED SHEET METAL
	GWB	GYPSUM WALL BOARD
H	H	HOUR(S)
	HACR	HEATING, AIR-CONDITIONING, AND REFRIGERATION
	HB	HOSE BIBB
	HC	HEATING COIL
	HCR	HOT/CHILLED WATER RETURN
	HCS	HOT/CHILLED WATER SUPPLY
	HGT	HEIGHT
	HID	HIGH INTENSITY DISCHARGE
	HOA	HAND-OFF-AUTOMATIC
	HORZ	HORIZONTAL
	HP	HORSEPOWER
	HVAC	HEATING, VENTILATING, AND AIR-CONDITIONING
	HZ	FREQUENCY, HERTZ
I	I=B=R	INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS
	ID	INSIDE DIAMETER
	IDEN	IDENTIFICATION
	IG	ISOLATED GROUND
	IN	INCH(ES)
	IN WG	INCHES OF WATER, GAUGE
	IND	INDEPENDENT
	INV	INVERT ELEVATION
	IPS	INTERNATIONAL PIPE STANDARD
J	J	JUNCTION BOX
K	KV	KILOVOLT(S)
	KVA	KILOVOLT AMPERE(S)
	KW	KILOWATT(S)
L	LAT	LEAVING AIR TEMPERATURE
	LB	POUND
	LB/HR	POUNDS/HOUR
	LCP	LOCAL CONTROL PANEL
	LF	LINEAR FEET
	LG	LENGTH
	LIQ	LIQUID
	LRA	LOCKED ROTOR AMPERES
	LWT	LEAVING WATER TEMPERATURE
M	M	MINUTE
	MAX	MAXIMUM
	MBH	ONE THOUSAND BTUH
	MCA	MINIMUM CIRCUIT AMPERES
	MCC	MOTOR CONTROL CENTER
	MCM	THOUSAND CIRCULAR MILS
	MDP	MAIN DISTRIBUTION PANEL
	MER	MECHANICAL EQUIPMENT ROOM
	MFA	MAXIMUM FUSE AMPERES
	MH	MOUNTING HEIGHT
	MIL	ONE THOUSANDTH
	MIN	MINIMUM
	MISC	MISCELLANEOUS
	MO	MOTOR OPERATED
	MS	MOTOR STARTER
	MTD	MOUNTED
N	N/A	NOT APPLICABLE
	NC	NORMALLY CLOSED
	NC	NOISE CRITERIA
	NEC	NATIONAL ELECTRICAL CODE
	NEG	NEGATIVE
	NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
	NIC	NOT IN CONTRACT
	NO	NORMALLY OPEN
	NO	NUMBER
	NOM	NOMINAL
	NPSH	NET POSITIVE SUCTION HEAD
	NRCA	NATIONAL ROOFING CONTRACTORS' ASSOCIATION
	NTS	NOT TO SCALE
O	OA	OUTDOOR AIR
	OC	ON CENTER
	OCC	OCCUPIED
	OD	OUTSIDE DIAMETER
	OED	OPEN END DUCT
	OGH	OUTSIDE GROUND HYDRANT
	OPER	OPERATING
	OPG	OPENING
	OS	OPEN SITE
	OWH	OUTSIDE WALL HYDRANT
	OV	OUTLET VELOCITY
P	P	POLE(S)
	PART	PARTIAL
	PD	PRESSURE DROP
	PERF	PERFORATED
	PH	PHASE
	P	PLATE
	PNEU	PNEUMATIC
	PNL	PANEL
	POS	POSITIVE
	PPM	PARTS PER MILLION
	PRESS	PRESSURE
	PSI	POUNDS PER SQUARE INCH
	PSIA	POUNDS PER SQUARE INCH ABSOLUTE
	PSIG	POUNDS PER SQUARE INCH GAUGE
	PVC	POLYVINYL CHLORIDE
	PVS	POLYVINYL COATED STEEL
	PW	PART WINDING
Q	QTY	QUANTITY
R	RA	RETURN AIR
	RAD	RADIATION
	REV	REVOLUTION
	REQ	REQUIRED
	RH	RELATIVE HUMIDITY
	RLA	RUNNING LOAD AMPERES
	RM	ROOM
	RMS	ROOT MEAN SQUARE
	RPM	REVOLUTIONS PER MINUTE
	RV	RADON VENT
	RX	REMOVE EXISTING
S	SA	SUPPLY AIR
	SAT	SATURATION
	SC	SHORT CIRCUIT
	SEC	SECONDS
	SEER	SEASONAL ENERGY EFFICIENCY RATIO
	SH	SENSIBLE HEAT
	SMACNA	SHEET METAL AND AIR-CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
	S/N	SOLID NEUTRAL
	SP	STATIC PRESSURE
	SPDT	SINGLE POLE DOUBLE THROW
	SPEC	SPECIFICATION
	SPST	SINGLE POLE SINGLE THROW
	SQ	SQUARE
	SQ FT	SQUARE FOOT
	STD	STANDARD
	STR	STRUCTURE
	SUCT	SUCTION
	SW	SWITCH
	SWBD	SWITCHBOARD
	SWSI	SINGLE WIDTH SINGLE INLET
T	TD	TEMPERATURE DIFFERENCE
	TDH	TOTAL DYNAMIC HEAD
	TEMP	TEMPERATURE
	TH	TOTAL HEAT
	THD	THREADED
	TONS	TONS OF REFRIGERATION
	TP	TOTAL PRESSURE
	TYP	TYPICAL
U	UON	UNLESS OTHERWISE NOTED
	UNOCC	UNOCCUPIED
	UST	UNDERGROUND STORAGE TANK
	UH	UNIT HEATER
V	V	VOLT(S)
	VA	VOLT AMPERE(S)
	VAV	VARIABLE AIR VOLUME
	VB	VACUUM BREAKER
	VEL	VELOCITY
	VERT	VERTICAL
	VFD	VARIABLE FREQUENCY DRIVE
	VOL	VOLUME
	VP	VELOCITY PRESSURE
	VTR	VENT THROUGH ROOF
W	W	WIRE(S)
	W/	WITH
	W/O	WITHOUT
	WBT	WET BULB TEMPERATURE
	WD	WIDTH
	WG	WATER GAUGE
	WT	WEIGHT
	WH	WATTHOUR
	WH	WALL HYDRANT
	WOG	WATER, OIL AND GAS PRESSURE
	WP	WEATHERPROOF
	WPD	WATER PRESSURE DROP
	WSP	WORKING STEAM PRESSURE
X	XFMR	TRANSFORMER
Y	YD	WYE DELTA

SYMBOLS

SYMBOL	DESCRIPTION
	EXISTING (LIGHT, SOLID)
	REMOVAL WORK
	NEW WORK (HEAVY, SOLID)
	POINT OF CONNECTION TO EXISTING
	POINT OF DISCONNECTION
	DIRECTION OF FLOW
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
HCS	HOT/CHILLED WATER SUPPLY
HCR	HOT/CHILLED WATER RETURN
CD	CONDENSATE DRAIN
SP	SPRINKLER MAIN
G	NATURAL GAS
RS	REFRIGERANT SUCTION
RL	REFRIGERANT LIQUID
	DOMESTIC COLD WATER
	DOMESTIC HOT WATER
	DOMESTIC HOT WATER RECIRCULATING
	DIRECTION OF PITCH
	PIPE DOWN
	PIPE UP
	END CAP
	GATE AS SPECIFIED
	GATE (VERTICAL)
	BUTTERFLY VALVE (BFV)
	GLOBE VALVE
	CHECK VALVE
	BALL VALVE
	PLUG VALVE
	CALIBRATED BALANCING VALVE
	FLEXIBLE PIPE CONNECTION
	UNION
	FLANGE CONNECTION
	STRAINER W/ BLOWDOWN
	2-WAY CONTROL VALVE
	3-WAY CONTROL VALVE
	SOLENOID VALVE
MOD	MOTOR OPERATED DAMPER
	PUMP
	DOUBLE BACKFLOW PREVENTER
	THERMOMETER
	PRESSURE GAUGE
	FLEXIBLE PIPE CONNECTOR
	ANCHOR
	GUIDE
	HOSE-END DRAIN
	AUTOMATIC AIR VENT
	MANUAL AIR VENT
	RELIEF SAFETY VALVE
	PRESSURE REDUCING VALVE
	PRESSURE AND TEMPERATURE PLUG
	THERMOMETER WELL
H	SPACE RELATIVE HUMIDITY SENSOR
T	DUCT-MOUNTED TEMPERATURE SENSOR
T	SPACE TEMPERATURE SENSOR
CO2	SPACE-MOUNTED CO2 SENSOR
CS	COMBINATION SENSOR - SPACE TEMPERATURE, HUMIDITY AND CO2
O	CEILING-MOUNTED OCCUPANCY SENSOR
1	REVISION NUMBER
2	SHEET NOTE NUMBER
3	GENERAL NOTE NUMBER

SYMBOL	DESCRIPTION
24"x12" 12"Ø	DUCT SIZE, RECTANGULAR OR ROUND (FIRST SIZE SHOWN IS SIDE SHOWN)
	ELBOW WITH TURNING VANES
8"x12" 8"x12" 6"x12" 12"x12" 6"x12" 12"x12"	TEE WITH TURNING VANES
	OVAL DUCT DESIGNATION
	ROUND DUCT DESIGNATION
VD VD	MANUAL VOLUME DAMPER (VD)
BD BD	BACKDRAFT DAMPER
S/D S/D	SMOKE DAMPER
F/S F/S	COMBINATION FIRE/SMOKE DAMPER
F/D F/D	FIRE DAMPER
AD AD 10"x10"	ACCESS DOOR
	FLEXIBLE DUCT OR FLEXIBLE CONNECTION
R D	INCLINED RISE OR DROP ARROW IN DIRECTION OF AIRFLOW
	TRANSITION FROM RECTANGULAR DUCT TO ROUND OR OVAL DUCT (FOR SINGLE LINE DUCT SEE ADJACENT DUCT SIZES)
	TRANSITION, RECTANGULAR (FOR SINGLE LINE DUCT SEE ADJACENT DUCT SIZES)
	45° RECTANGULAR/SQUARE TAKE-OFF
	POSITIVE PRESSURE DUCT TURNING DOWN
	POSITIVE PRESSURE DUCT TURNING UP
	NEGATIVE PRESSURE DUCT TURNING DOWN
	NEGATIVE PRESSURE DUCT TURNING UP
CG-1 150	CEILING MOUNTED RETURN OR EXHAUST GRILLE INDICATES TYPE, REFER TO SCHEDULE INDICATES CFM
CD-1 150	CEILING MOUNTED SUPPLY AIR DIFFUSER INDICATES TYPE, REFER TO SCHEDULE INDICATES CFM
U/C	UNDERCUT DOOR (1" UON)
D/L (12"x12")	DOOR LOUVER (W/ SIZE)
	GYPSUM BOARD/PLASTER CEILING
S	CEILING MOUNTED SPEAKER
C	CEILING MOUNTED SECURITY CAMERAS
FA	CEILING MOUNTED FIRE ALARM DEVICES
J	CEILING MOUNTED JUNCTION BOX
IT	CEILING MOUNTED WIFI / IT DEVICE
	CEILING MOUNTED SPRINKLER HEAD

GENERAL NOTES

1. ALL WORK SHALL COMPLY WITH ALL APPLICABLE CODES INCLUDING REQUIREMENTS OF LOCAL AUTHORITIES.
2. SPECIFICATIONS INCLUDE ADDITIONAL WORK THAT MAY NOT BE INDICATED ON THE DRAWINGS; REVIEW SPECIFICATIONS CAREFULLY.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED FOR THIS PROJECT. COORDINATE WORK WITH APPROPRIATE AUTHORITIES HAVING JURISDICTION AND OBTAIN ALL NECESSARY PERMITS AND INSPECTIONS. WHEN WORK IS COMPLETE, PROVIDE OWNER WITH APPROPRIATE CERTIFICATE OF FINAL INSPECTION AND COMPLETION FROM SAID AUTHORITIES.
4. CONTRACTOR SHALL TAKE PRECAUTIONS TO PREVENT DAMAGE TO BUILDING COMPONENTS NOT INCLUDED IN THE PROJECT. IF ANY DAMAGE OCCURS, CONTRACTOR SHALL REPAIR DAMAGE USING SAME MATERIAL AND FINISHES AS EXISTING.
5. REPAIR ALL DAMAGE TO WALLS, CEILINGS, FLOORS AND ANY OTHER EXISTING CONSTRUCTION RESULTING FROM WORK. FINISHED REPAIRS SHALL MATCH EXISTING ADJACENT CONSTRUCTION AND FINISH AND SHALL BE TO THE HCPSS PROJECT COORDINATOR'S SATISFACTION AND APPROVAL. WHILE SCHOOL IS IN SESSION NO SUCH DAMAGE SHALL BE LEFT UNREPAIRED AT THE START OF SCHOOL HOURS.
6. RELOCATE OR REWORK EXISTING LIGHTS, PIPING, DUCTWORK, CONDUIT, WIRING AND ALL OTHER BUILDING COMPONENTS AS NECESSARY FOR COMPLETION OF WORK.
7. THE CONTRACTOR SHALL BECOME THOROUGHLY FAMILIAR WITH THE SITE AND THE CONDITIONS UNDER WHICH THE WORK WILL BE PERFORMED, INCLUDING AVAILABLE SPACE, EXISTING CONSTRUCTION (I.E. FULL-HEIGHT CMU AND OTHER WALLS). ALL COSTS ASSOCIATED WITH THE CONTRACTOR'S FAILURE TO BECOME FAMILIAR WITH THE SITE SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. THE CONTRACTOR SHALL FIELD VERIFY ALL NECESSARY DIMENSIONS PRIOR TO COMMENCING WORK AND FABRICATING COMPONENTS.
9. LOCATION OF EXISTING WORK SHOWN ON DRAWINGS IS BASED ON ORIGINAL CONSTRUCTION DRAWINGS. CONTRACTOR SHALL FIELD VERIFY EXISTING SIZES AND CLEARANCES WHERE NEW EQUIPMENT, DUCT, PIPE AND ACCESSORIES ARE INSTALLED BEFORE MANUFACTURING DUCT OR INSTALLING EQUIPMENT. NOTIFY HCPSS PROJECT COORDINATOR OF CONFLICTS BEFORE FABRICATING MATERIAL AND INSTALLING EQUIPMENT.
10. WHEN WORK SPECIFIED OR SHOWN ON THE DRAWING REQUIRES RELOCATING EXISTING UTILITIES, POWER, TELECOMMUNICATIONS, PIPING, DUCTWORK OR EQUIPMENT, THE CONTRACTOR SHALL PERFORM ALL WORK AND MAKE ALL NECESSARY CHANGES TO EXISTING BUILDING COMPONENTS AS MAY BE REQUIRED TO LEAVE THE ENTIRE COMPLETE WORK IN A FINISHED AND WORKMANLIKE CONDITION TO THE ENTIRE SATISFACTION OF THE HCPSS PROJECT COORDINATOR REGARDLESS OF WHETHER OR NOT THESE CHANGES ARE SPECIFICALLY CALLED FOR BY THE SPECIFICATIONS OR SHOWN ON THE DRAWINGS. ALL WORK PERFORMED ON THE EXISTING POWER SYSTEMS, PIPING SYSTEMS, DUCTWORK OR EQUIPMENT SHALL BE DONE IN ACCORDANCE WITH APPLICABLE PROVISIONS OF THE SPECIFICATIONS INCLUDING MATERIALS, PAINTING, INSULATION, ETC. AND CURRENT BUILDING CODES.
11. CONTRACTOR SHALL PROVIDE A WARRANTY FOR ALL WORK INCLUDED IN THIS PROJECT FOR A MINIMUM PERIOD OF TWO YEARS FROM THE DATE OF SUBSTANTIAL COMPLETION. WARRANTY SHALL INCLUDE 24 HOUR SERVICE.
12. IN THE EVENT OF A CONFLICT AMONG DRAWINGS, NOTES, DETAILS AND SPECIFICATIONS, CONTRACTOR SHALL CONTACT ENGINEER WITHIN TIME PERIOD ESTABLISHED AT THE PRE-BID MEETING FOR CLARIFICATION. AFTER THIS TIME PERIOD CONTRACTOR SHALL ASSUME THAT MOST STRINGENT AND CONSERVATIVE OF THE CONFLICT WILL APPLY.
13. CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, PROCEDURES AND JOB SITE SAFETY.
14. WHEN EQUIPMENT AND MATERIALS IS TEMPORARILY STORED OUTSIDE BEFORE INSTALLATION, CONTRACTOR SHALL PROTECT IT FROM ADVERSE WEATHER CONDITIONS.
15. COORDINATE LOCATION AND INSTALLATION OF EQUIPMENT WITH OTHER TRADES. VERIFY THAT MANUFACTURER'S REQUIRED CLEARANCES FOR MAINTENANCE AND OPERATION ARE PROPERLY MAINTAINED. ARRANGE EQUIPMENT AND PIPING TO ALLOW ACCESS TO VALVES, DRAINS, CONTROLS, AND MAINTENANCE OF EQUIPMENT.
16. DRAWINGS ARE BASED ON EXISTING PLANS AND FIELD VERIFICATION WHERE FEASIBLE. ACTUAL CONDITIONS MAY DIFFER FROM THOSE INDICATED. CONTRACTOR TO FIELD VERIFY IN ADVANCE THE LOCATION AND CONDITION OF THOSE EXISTING SYSTEMS SHOWN TO BE MODIFIED OR REMOVED. CONTRACTOR SHALL NOTIFY ENGINEER IF CONDITIONS DIFFER SIGNIFICANTLY FROM CONSTRUCTION DOCUMENTS.

EXISTING ROOF INFORMATION

THE EXISTING ROOF IS A BUILT-UP ROOF WITH GRAVEL. IT WAS INSTALLED IN 1999 AND IS OUT OF WARRANTY. HCPSS RECOMMENDS TECTA AMERICA FOR THIS WORK. POINT OF CONTACT CHRIS SARGENT (443-506-4691); HOWEVER, OTHER EXPERIENCED ROOFERS MAY ALSO BE USED.

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

MECHANICAL ABBREVIATIONS, SYMBOLS & GENERAL NOTES

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	AS SHOWN

SHEET

M0.1

DRAWING NOTES

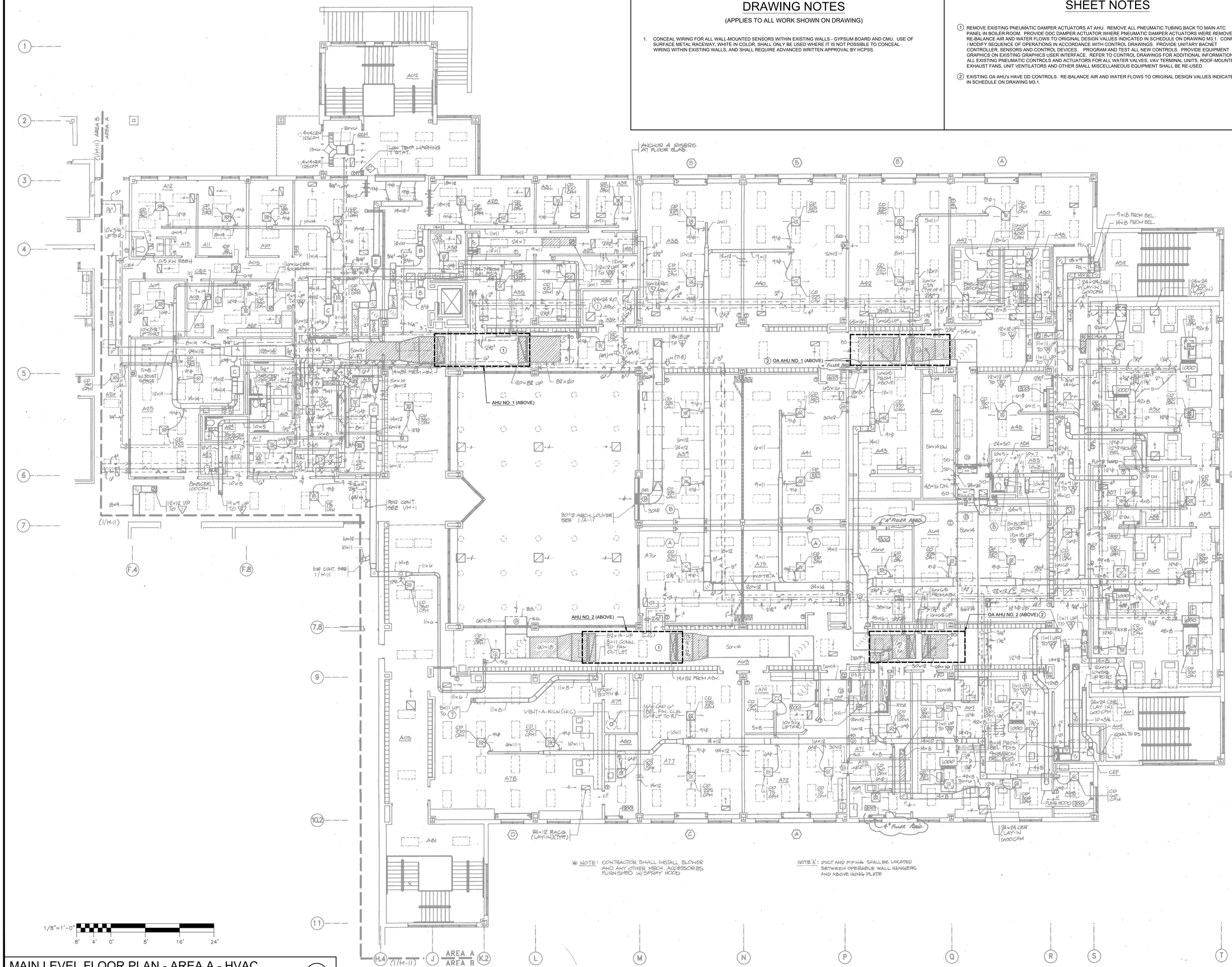
(APPLIES TO ALL WORK SHOWN ON DRAWING)

1. CONCEAL WIRING FOR ALL WALL-MOUNTED SENSORS WITHIN EXISTING WALLS - GYPSUM BOARD AND CMU. USE OF SURFACE METAL RACEWAY, WHITE IN COLOR, SHALL ONLY BE USED WHERE IT IS NOT POSSIBLE TO CONCEAL WIRING WITHIN EXISTING WALLS, AND SHALL REQUIRE ADVANCED WRITTEN APPROVAL BY HCPSS.

SHEET NOTES

1. REMOVE EXISTING PNEUMATIC DAMPER ACTUATORS AT AHU. REMOVE ALL PNEUMATIC TUBING BACK TO MAIN ATC PANEL IN BOILER ROOM. PROVIDE DDC DAMPER ACTUATOR WHERE PNEUMATIC DAMPER ACTUATORS WERE REMOVED. RE-BALANCE AIR AND WATER FLOWS TO ORIGINAL DESIGN VALUES INDICATED IN SCHEDULE ON DRAWING M3.1. CONFIRM / MODIFY SEQUENCE OF OPERATIONS IN ACCORDANCE WITH CONTROL DRAWINGS. PROVIDE UNITARY BACNET CONTROLLER, SENSORS AND CONTROL DEVICES. PROGRAM AND TEST ALL NEW CONTROLS. PROVIDE EQUIPMENT GRAPHICS ON EXISTING GRAPHICS USER INTERFACE. REFER TO CONTROL DRAWINGS FOR ADDITIONAL INFORMATION. ALL EXISTING PNEUMATIC CONTROLS AND ACTUATORS FOR ALL WATER VALVES, VAV TERMINAL UNITS, ROOF-MOUNTED EXHAUST FANS, UNIT VENTILATORS AND OTHER SMALL MISCELLANEOUS EQUIPMENT SHALL BE RE-USED.

2. EXISTING OA AHU's HAVE DD CONTROLS. RE-BALANCE AIR AND WATER FLOWS TO ORIGINAL DESIGN VALUES INDICATED IN SCHEDULE ON DRAWING M3.1.



1/8"=1'-0"

8" 4" 0" 8" 16" 24"

MAIN LEVEL FLOOR PLAN - AREA A - HVAC

1

SCALE: 1/8" = 1' - 0"

Howard County Public School System

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics

8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

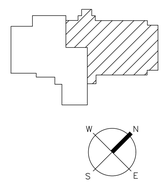
ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

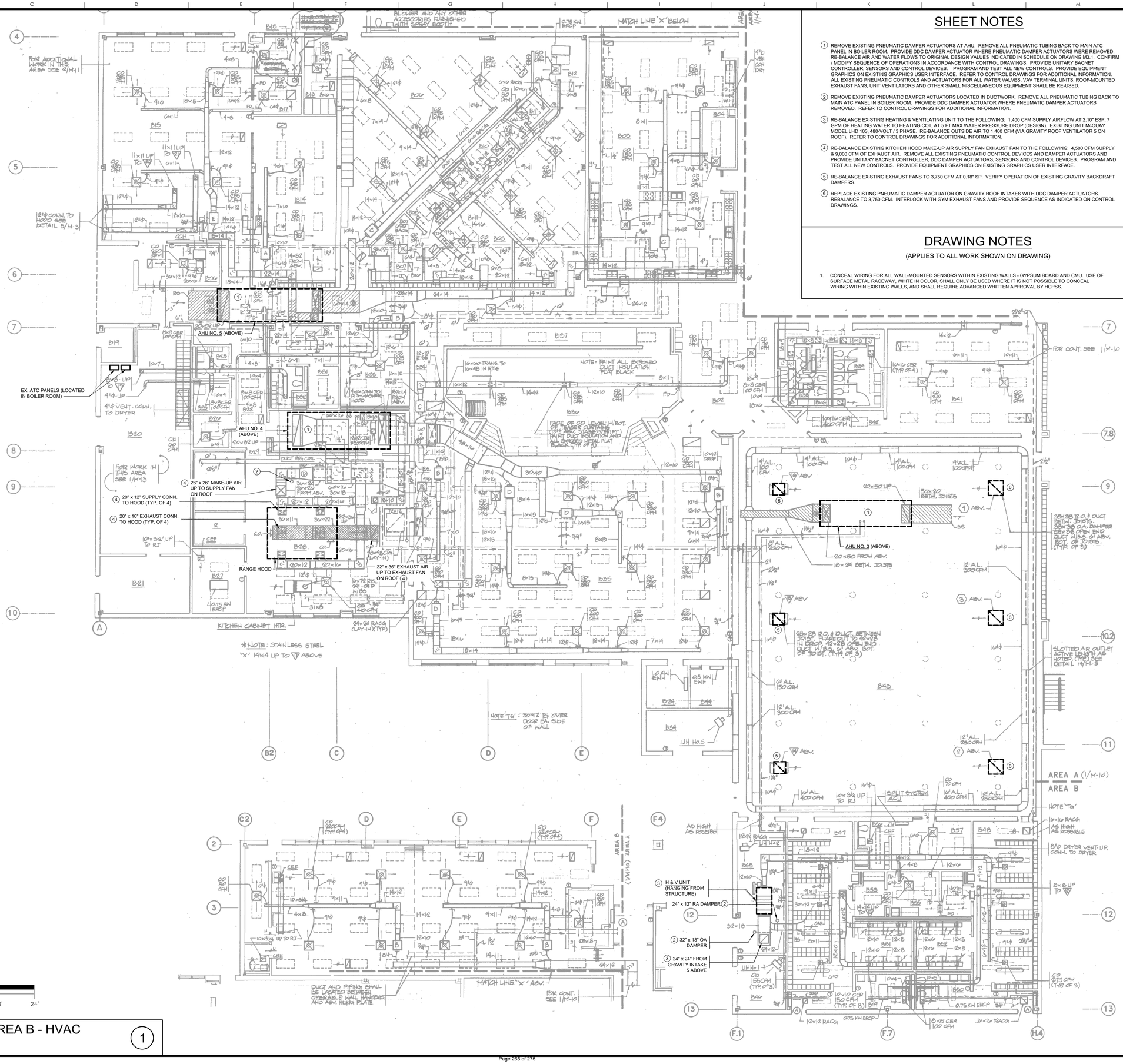


NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

MAIN LEVEL FLOOR PLAN - AREA A - HVAC

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	1/8"=1'-0"
SHEET	M2.1



1/8"=1'-0"

8' 4' 0' 8' 16' 24'

MAIN LEVEL FLOOR PLAN - AREA B - HVAC

1

SCALE: 1/8" = 1' - 0"

SHEET NOTES

1. REMOVE EXISTING PNEUMATIC DAMPER ACTUATORS AT AHU. REMOVE ALL PNEUMATIC TUBING BACK TO MAIN ATC PANEL IN BOILER ROOM. PROVIDE DDC DAMPER ACTUATOR WHERE PNEUMATIC DAMPER ACTUATORS WERE REMOVED. RE-BALANCE AIR AND WATER FLOWS TO ORIGINAL DESIGN VALUES INDICATED IN SCHEDULE ON DRAWING M3.1. CONFIRM / MODIFY SEQUENCE OF OPERATIONS IN ACCORDANCE WITH CONTROL DRAWINGS. PROVIDE UNITARY BACNET CONTROLLER, SENSORS AND CONTROL DEVICES. PROGRAM AND TEST ALL NEW CONTROLS. PROVIDE EQUIPMENT GRAPHICS ON EXISTING GRAPHICS USER INTERFACE. REFER TO CONTROL DRAWINGS FOR ADDITIONAL INFORMATION. ALL EXISTING PNEUMATIC CONTROLS AND ACTUATORS FOR ALL WATER VALVES, VAV TERMINAL UNITS, ROOF-MOUNTED EXHAUST FANS, UNIT VENTILATORS AND OTHER SMALL MISCELLANEOUS EQUIPMENT SHALL BE RE-USED.
2. REMOVE EXISTING PNEUMATIC DAMPER ACTUATORS LOCATED IN DUCTWORK. REMOVE ALL PNEUMATIC TUBING BACK TO MAIN ATC PANEL IN BOILER ROOM. PROVIDE DDC DAMPER ACTUATOR WHERE PNEUMATIC DAMPER ACTUATORS REMOVED. REFER TO CONTROL DRAWINGS FOR ADDITIONAL INFORMATION.
3. RE-BALANCE EXISTING HEATING & VENTILATING UNIT TO THE FOLLOWING: 1,400 CFM SUPPLY AIRFLOW AT 2.10" ESP, 7 GPM OF HEATING WATER TO HEATING COIL AT 5 FT MAX WATER PRESSURE DROP (DESIGN). EXISTING UNIT McQUAY MODEL LHD 103..480-VOLT / 3 PHASE. RE-BALANCE OUTSIDE AIR TO 1,400 CFM (VIA GRAVITY ROOF VENTILATOR 5 ON ROOF). REFER TO CONTROL DRAWINGS FOR ADDITIONAL INFORMATION.
4. RE-BALANCE EXISTING KITCHEN HOOD MAKE-UP AIR SUPPLY FAN EXHAUST FAN TO THE FOLLOWING: 4,500 CFM SUPPLY & 9,000 CFM OF EXHAUST AIR. REMOVE ALL EXISTING PNEUMATIC CONTROL DEVICES AND DAMPER ACTUATORS AND PROVIDE UNITARY BACNET CONTROLLER, DDC DAMPER ACTUATORS, SENSORS AND CONTROL DEVICES. PROGRAM AND TEST ALL NEW CONTROLS. PROVIDE EQUIPMENT GRAPHICS ON EXISTING GRAPHICS USER INTERFACE.
5. RE-BALANCE EXISTING EXHAUST FANS TO 3,750 CFM AT 0.18" SP. VERIFY OPERATION OF EXISTING GRAVITY BACKDRAFT DAMPERS.
6. REPLACE EXISTING PNEUMATIC DAMPER ACTUATOR ON GRAVITY ROOF INTAKES WITH DDC DAMPER ACTUATORS. REBALANCE TO 3,750 CFM. INTERLOCK WITH GYM EXHAUST FANS AND PROVIDE SEQUENCE AS INDICATED ON CONTROL DRAWINGS.

DRAWING NOTES

(APPLIES TO ALL WORK SHOWN ON DRAWING)

1. CONCEAL WIRING FOR ALL WALL-MOUNTED SENSORS WITHIN EXISTING WALLS - GYPSUM BOARD AND CMU. USE OF SURFACE METAL RACEWAY, WHITE IN COLOR, SHALL ONLY BE USED WHERE IT IS NOT POSSIBLE TO CONCEAL WIRING WITHIN EXISTING WALLS, AND SHALL REQUIRE ADVANCED WRITTEN APPROVAL BY HCPSS.

Howard County Public School System

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics

8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

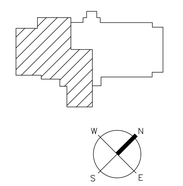
ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN



NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

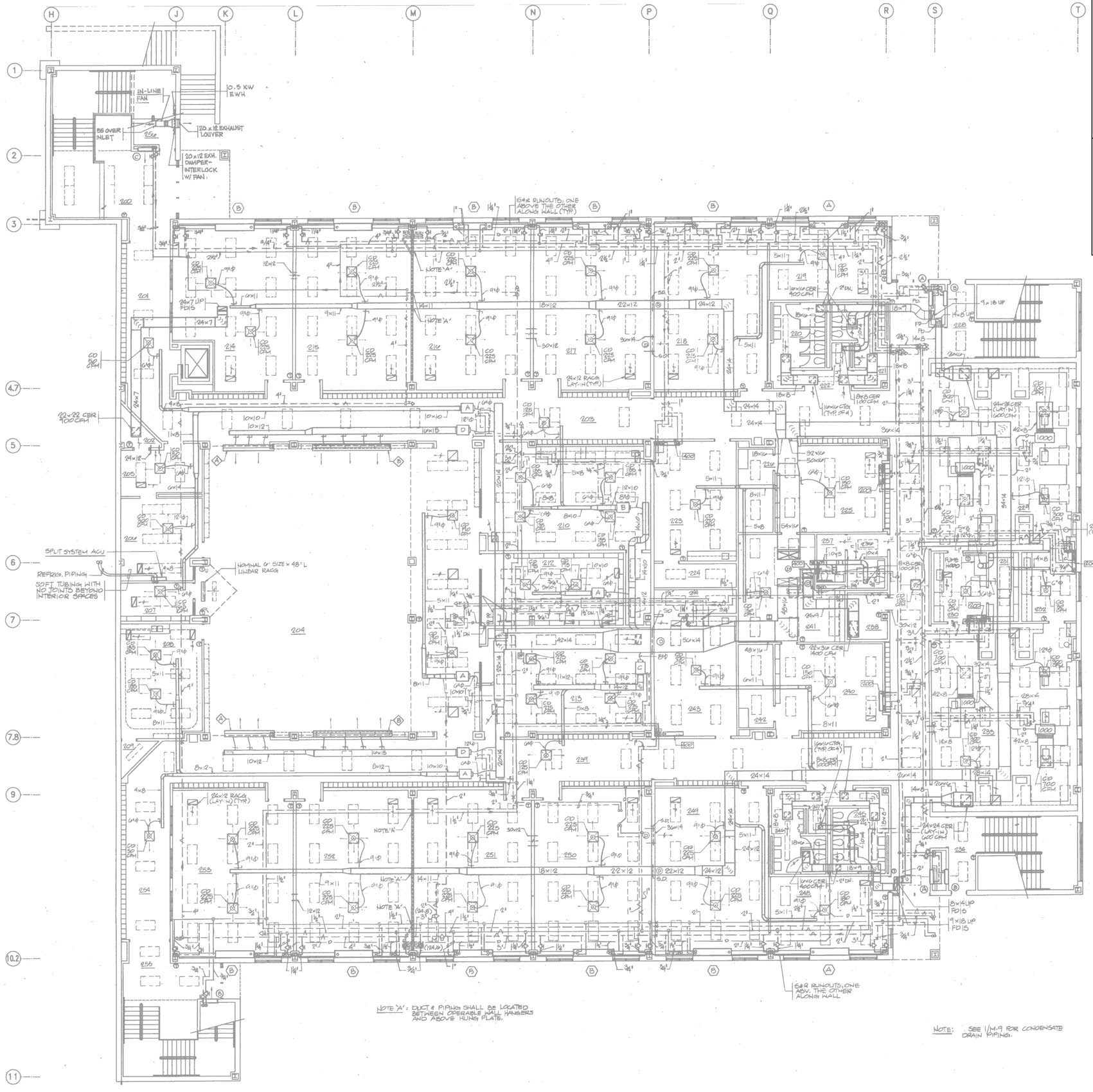
DRAWING

MAIN LEVEL FLOOR PLAN - AREA B - HVAC

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	1/8"=1'-0"

SHEET

M2.2



SHEET NOTES

1. DRAWING PROVIDED FOR REFERENCE ONLY.

DRAWING NOTES

(APPLIES TO ALL WORK SHOWN ON DRAWING)

1. CONCEAL WIRING FOR ALL WALL-MOUNTED SENSORS WITHIN EXISTING WALLS - GYPSUM BOARD AND CMU. USE OF SURFACE METAL RACEWAY, WHITE IN COLOR, SHALL ONLY BE USED WHERE IT IS NOT POSSIBLE TO CONCEAL WIRING WITHIN EXISTING WALLS, AND SHALL REQUIRE ADVANCED WRITTEN APPROVAL BY HCPSS.

1/8"=1'-0"

8' 4' 0' 8' 16' 24'

① LOWER LEVEL FLOOR PLAN - HVAC

SCALE: 1/8" = 1' - 0"

1

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

LOWER LEVEL FLOOR PLAN - HVAC

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	1/8"=1'-0"

SHEET

M2.3

No.	AREA SERVED	SUPPLY FAN				MIN. O.A.	COOLING COIL			HEATING COIL			DX COOLING COIL			RETURN AIR FAN			REMARKS				McQUAY MODEL No.
		CFM	EXT. S.P.	TOTAL S.P.	FAN MOTOR HP	CFM	ENT. AIR FDB/FWB	LVG. AIR FDB/FWB	GPM 45 F ENT. WATER	ENT. AIR FDB	LVG. AIR FDB	GPM 200 F ENT. WATER	ENT. AIR FDB/FWB	LVG. AIR FDB/FWB	SAT'D. SUCT. TEMP (F)	CFM	T.S.P.	MOTOR HP	TYPE SYSTEM	SUPPLY FAN	RETURN AIR FAN	CAPACITY CONTROL	
1	ADMINISTRATION	7500	2.75"	4.60"	10	2400	85.0/70.0	56.5/55.7	58	47.6	62.0	6.0	85.0/70.0	56.5/55.7	46.0	6200	0.50"	2	VAV	20 AF	30 AF	FACE & BY-PASS DPRS.	RDS - 800C
2	MEDIA CENTER	6400	2.65"	4.10"	7.5	2000	84.8/69.8	56.5/55.8	48	48.1	62.0	5.0	--	--	--	4400	0.55"	1.5	VAV	20 AF	30 AF	FACE & BY-PASS DPRS.	RDS - 800C
3	GYMNASIUM	3000	1.20"	2.40"	3	* 3000/ 1600	-- --	-- --	--	0	100.0	16.0	--	--	--	3000	0.25"	1	CONSTANT VOLUME	15x9 FC	15x15 FC	FACE & BY-PASS DPRS.	RDS - 708B-S
4	CAFETERIA	7150	1.75"	4.40"	10	* 4500/ 1000	88.7/74.3	53.0/52.2	88	26.0	62.0	14	--	--	--	6800/ ** 2650	0.60"	3	VAV	20 AF	30 AF	FACE & BY-PASS DPRS.	RDS - 800C
5	MUSIC / TECH. ED.	6050	2.70"	4.15"	7.5	3750	89.1/74.1	55.0/54.5	69	26.5	62.0	12	--	--	--	5750	0.50"	2	VAV	20 AF	30 AF	FACE & BY-PASS DPRS.	RDS - 800C

NOTES:

1. 600 FPM MAXIMUM COIL FACE VELOCITY.
2. 1.0" CHILLED WATER COIL AIRSIDE PRESSURE DROP.
3. 15 FT. MAXIMUM CHILLED WATER COIL WATER PRESSURE DROP.
4. 0.25" MAX. HEATING COIL AIRSIDE PRESSURE DROP
5. 8 FT. MAX. HEATING COIL WATER PRESS. DROP
6. PROVIDE 1.0 KW ELECTRIC STRIP HEATER (U.L. LISTED) W/ INTERGRAL THERMOSTAT IN COIL SECTION, ALL UNITS. 277V/1PH.
7. ALL COILS, 10 FINS / INCH MAXIMUM.
8. * HIGH/LOW OCCUPANCY SELECTION.
9. 0.75" MAX. DX COIL AIRSIDE PRESSURE DROP.
10. ALL SUPPLY & RETURN AIR FANS FOR VAV UNITS SHALL HAVE INLET VANES.
11. FAN STATIC PRESSURES AND MOTOR HP'S SCHEDULED ARE PREDICATED ON BASIS OF DESIGN MANUFACTURER FAN CURVES WHICH INCLUDE CERTAIN INTERNAL PRESSURE LOSSES. OTHER MANUFACTURERS SHALL ACCOUNT FOR ANY DIFFERENCES IN SELECTION PROCEDURE.
12. ALL UNITS SHALL HAVE AN INDEPENDENT HORIZONTAL DISCHARGE PLENUM BETWEEN FAN SECTION AND DOWN DISCHARGE PLENUM
13. 480v/3PH., SINGLE POWER ENTRY.
14. * * REDUCED R.A. CFM-RANGE HOOD EXH. INTERLOCK

1
M-6

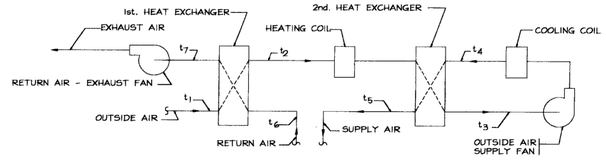
EXISTING ROOFTOP AIR-HANDLING UNIT SCHEDULE (FOR REFERENCE ONLY)

No.	FIRST HEAT EXCHANGER - SUMMER								SECOND HEAT EXCHANGER - SUMMER							COOLING COIL						
	O. A. SUPPLY AIR CFM	t_1 (FDB/FWB)	t_2 (FDB/FWB)	R.A. - EXH. AIR CFM	t_6 (FDB)	t_7 (FDB)	HEAT TRANSFER (MBH)	AIR PRESS. DROP	CFM	t_2 (FDB/FWB)	t_3 (FDB/FWB)	t_4 (FDB/FWB)	t_5 (FDB/FWB)	HEAT TRANSFER (MBH)	AIR PRESS. DROP	CFM	ENT. AIR (FDB/FWB)	LVG. AIR-t4 (FDB/FWB)	GPM - 45F ENT. WTR.	WTR. PRESS. DROP	AIR PRESS. DROP	CAP'Y. (MBH)
1	7235	95/78	87.9/76.2	4035	80.0	92.7	54.9	0.49"	7235	87.9/76.2	69.8/69.8	55.0/54.7	77.1/63.0	170.2	0.71"	7235	72.8/70.0	55.0/54.7	60.0	23	0.43"	365.6
2	7355	95/78	87.3/76.0	4655	80.0	92.2	60.7	0.63"	7355	87.3/76.0	69.9/69.9	55.0/54.7	77.3/63.0	174.5	0.73"	7355	72.9/70.0	55.0/54.7	61.0	24	0.45"	148.2

No.	FIRST HEAT EXCHANGER - WINTER								HEATING COIL							O. A. SUPPLY FAN			R. A. - EXHAUST FAN			DES CHAMPS LABORATORIES, WRINGER PLUS MODEL No.
	O. A. SUPPLY AIR CFM	t_1 (F)	t_2 (F)	R.A. - EXH. AIR CFM	t_6 (F)	t_7 (F)	HEAT TRANSFER (MBH)	AIR PRESS. DROP	CFM	ENT. AIR-t2 (F)	ENT. AIR-t3 (F)	GPM-200F ENT. WTR.	WTR. PRESS. DROP (FT.)	AIR PRESS. DROP	CAP'Y. (MBH)	CFM	EXT. SP	MOTOR HP	CFM	EXT. SP	MOTOR HP	
1	7235	0	30.1	4035	55	14.6	229.4	0.44"	7235	30.1	70.0	15.5	5	0.10	312.6	7235	1.35"	15	4035	0.45"	3	MWP6
2	7355	0	32.2	4655	55	16.8	249.6	0.56"	7355	32.2	70.0	15	4.5	0.10	301.8	7355	1.0"	15	4655	0.30"	3	MWP6

NOTES:

1. 10 FINS/INCH MAX. COIL FIN SPACING.
2. PROVIDE 1KW STRIP HEATER W/INTEGRAL THERMOSTAT IN EACH COIL SECTION (277V./1Ø).
3. 480V./3Ø POWER.
4. 1.5" ALLOWANCE FOR FILTER PRESSURE DROP IN INTERNAL S. P.



OA AHU FLOW DIAGRAM

2
M-6

EXISTING OUTSIDE AIR AIR-HANDLING UNIT SCHEDULE (FOR REFERENCE ONLY)

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building DYNAMICS
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

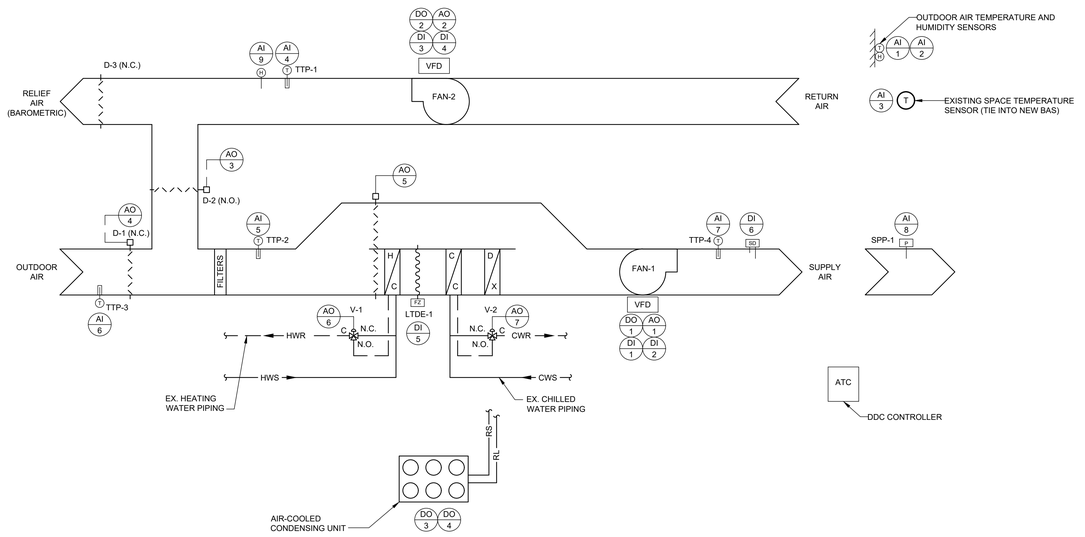
NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

MECHANICAL SCHEDULES & DETAILS

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	NONE
SHEET	

M3.1

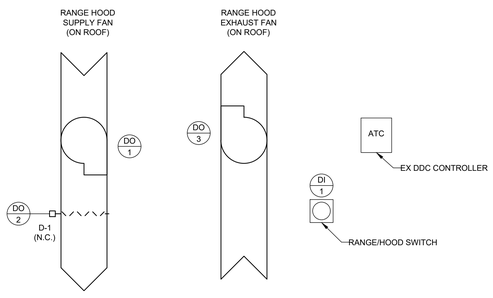


DDC POINT LIST (AHU-1)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
ANALOG INPUT	AI-1	OUTDOOR AIR TEMPERATURE (NETWORK)	TREND	NEW	
	AI-2	OUTDOOR AIR HUMIDITY (NETWORK)	TREND	NEW	
	AI-3	ZONE TEMPERATURE SENSORS (TYP OF 2)	TREND	NEW	
	AI-4	RETURN AIR TEMPERATURE	TREND	NEW	
	AI-5	MIXED AIR TEMPERATURE	TREND	NEW	
	AI-6	OUTDOOR AIR TEMPERATURE	TREND	NEW	
	AI-7	SUPPLY AIR TEMPERATURE	TREND	NEW	
	AI-8	2/3 DUCT STATIC PRESSURE	TREND	NEW	
	AI-9	RETURN AIR HUMIDITY	TREND	NEW	
DIGITAL INPUT	DI-1	SUPPLY FAN STATUS	TREND	NEW	
	DI-2	SUPPLY FAN FAULT	TREND	NEW	1
	DI-3	RETURN FAN STATUS	TREND	NEW	
	DI-4	RETURN FAN FAULT	TREND	NEW	1
	DI-5	FREEZE STAT STATUS	TREND	NEW	2
	DI-6	SMOKE DETECTOR STATUS	TREND	NEW	2
ANALOG OUTPUT	AO-1	SUPPLY FAN SPEED	TREND	NEW	
	AO-2	RETURN FAN SPEED	TREND	NEW	
	AO-3	MIXED AIR DAMPER	TREND	NEW	
	AO-4	OUTDOOR AIR DAMPER	TREND	NEW	
	AO-5	FACE/BYPASS DAMPER	TREND	NEW	
	AO-6	COOLING COIL VALVE	TREND	NEW	
	AO-7	HEATING COIL VALVE	TREND	NEW	
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND	NEW	
	DO-2	RETURN FAN START/STOP	TREND	NEW	
	DO-3	DX COOLING STAGE 1	TREND	NEW	
	DO-4	DX COOLING STAGE 2	TREND	NEW	

NOTE 1: ISSUE VIRTUAL ALARM IF STATUS DOES NOT MATCH COMMAND AFTER 30 SECONDS.
NOTE 2: ISSUE DAL OUT ALARM IF SAFETY IS ACTIVE.

1 M5.1 AIR-HANDLING UNIT CONTROL DIAGRAM (AHU-1)
NO SCALE



SEQUENCE OF OPERATIONS (KITCHEN HOOD)

UNIT OPERATION:

RANGE SUPPLY FAN SHALL BE INTERLOCKED WITH THE KITCHEN HOOD EXHAUST FAN. WHEN EXHAUST FAN STARTS SUPPLY FAN SHALL START AND AIR DAMPER SHALL OPEN,

DDC POINT LIST (KITCHEN HOOD)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
DIGITAL INPUT	DI-1	KITCHEN HOOD SWITCH STATUS	TREND	NEW	
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND	NEW	
	DO-2	SUPPLY FAN DAMPER	TREND	NEW	
	DO-3	EXHAUST FAN START/STOP	TREND	NEW	

2 M5.1 KITCHEN RANGE HOOD
NO SCALE

SEQUENCE OF OPERATION (AHU-1)

GENERAL

THE AIR-HANDLING UNIT SHALL BE CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS) CONTROLLER FURNISHED AND FIELD-INSTALLED BY THE ATC CONTRACTOR.

VAV INTERLOCK

THE EXISTING INTERLOCK WITH THE PNEUMATIC VAV BOXES SHALL BE RETAINED, TO ALLOW FOR THE VAV BOXES TO OPERATE ON THE SAME OCCUPIED SCHEDULE AS THE CORRESPONDING AIR-HANDLING UNIT.

SMOKE DAMPER CONTROL

DUCT SMOKE DETECTORS SHALL BE SUPPLIED WITH CONTROL MAIN AIR FROM AN EP SWITCH ENERGIZED BY THE SUPPLY FAN STARTER. END SWITCHES SHALL BE NORMALLY OPEN AND WIRED IN SERIES TO KEEP THE SUPPLY FAN DEENERGIZED UNTIL THE SMOKE DAMPERS ARE FULLY OPEN.

FAN SPEED CONTROL

WHEN ENERGIZED, THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE STATIC PRESSURE SETPOINT OF THE SUPPLY AIR STATIC PRESSURE SENSOR. THE RETURN FAN SHALL TRACK THE SUPPLY FAN WITH AN ADJUSTABLE OFFSET SET BY THE TEST AND BALANCE CONTRACTOR.

MECHANICAL COOLING CAPACITY CONTROL

THE MECHANICAL COOLING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY OPENING THE CHILLED WATER COIL CONTROL VALVE TO THE COIL, AND USING THE FACE & BYPASS DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.

HEATING CAPACITY CONTROL

THE HEATING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY OPENING THE HEATING WATER COIL CONTROL VALVE TO THE COIL, AND USING THE FACE & BYPASS DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.

MORNING WARM-UP/COOL-DOWN MODE

WHEN INDEXED TO THE OCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE UNIT SHALL BE PLACED IN EITHER THE WARM-UP OR COOL-DOWN MODE. WHEN THE RETURN AIR TEMPERATURE IS BELOW 68°F, THE UNIT SHALL BE PLACED IN THE WARM-UP MODE; WHEN THE RETURN AIR TEMPERATURE IS ABOVE 68°F, THE UNIT SHALL BE PLACED IN THE COOL-DOWN MODE.

IN BOTH THE WARM-UP AND COOL-DOWN MODES, THE SUPPLY FAN SHALL BE ENERGIZED AND RUN CONTINUOUSLY, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

IN THE WARM-UP MODE, THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE. THE WARM-UP MODE SHALL CONTINUE UNTIL THE RETURN AIR TEMPERATURE REACHES 68°F. IN THE COOL-DOWN MODE, THE COOLING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN THE 55°F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE SETPOINT. THE COOL-DOWN MODE SHALL CONTINUE UNTIL THE RETURN AIR TEMPERATURE REACHES 76°F.

OCCUPIED MODE

WHEN THE WARM-UP/COOL-DOWN MODE IS COMPLETED, THE SUPPLY AND RETURN FANS SHALL OPERATE AS DESCRIBED IN THE FAN SPEED CONTROL SECTION ABOVE. THE MINIMUM OUTDOOR AIR AND RETURN AIR DAMPERS SHALL POSITION TO PROVIDE MINIMUM OUTDOOR AIRFLOW. THE EXHAUST AIR DAMPER SHALL BE CLOSED.

MINIMUM OUTDOOR AIR MODE

THE DISCHARGE AIR TEMPERATURE SHALL BE RESET BASED ON THE RETURN AIR TEMPERATURE AS FOLLOWS:

A. DISCHARGE AIR TEMPERATURE SHALL BE 55°F WHEN THE RETURN AIR TEMPERATURE IS 72°F OR HIGHER.

B. DISCHARGE AIR TEMPERATURE SHALL BE 62°F WHEN THE RETURN AIR TEMPERATURE IS LOWER THAN 72°F.

UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE SETPOINT, MECHANICAL COOLING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE MECHANICAL COOLING CAPACITY CONTROL SECTION ABOVE.

UPON A DROP IN DISCHARGE AIR TEMPERATURE BELOW SETPOINT, HEATING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE HEATING CAPACITY CONTROL SECTION ABOVE.

UPON A DROP IN MIXED AIR TEMPERATURE BELOW 38°F, THE OUTDOOR AIR DAMPER SHALL MODULATE CLOSED AND THE RETURN AIR DAMPER SHALL MODULATE OPEN. THE MIXED AIR TEMPERATURE LOW LIMIT CONTROL SHALL CONTINUE WITH A 2°F DEADBAND.

ENTHALPY ECONOMIZER MODE

ECONOMIZER MODE SHALL BE ENABLED WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR WHEN THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F. IF THE UNIT IS NOT IN THE FREE COOLING MODE DURING ECONOMIZER MODE, THE MAXIMUM OUTDOOR AIR DAMPER AND EXHAUST AIR DAMPER SHALL BE FULLY OPENED, AND THE RETURN AIR DAMPER SHALL BE CLOSED. MECHANICAL COOLING SHALL NOT BE LOCKED OUT.

UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE SETPOINT, MECHANICAL COOLING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE MECHANICAL COOLING CAPACITY CONTROL SECTION ABOVE.

IF THE OUTDOOR AIR ENTHALPY RISES ABOVE THE RETURN AIR ENTHALPY WITH A 3 BTU/LB DEADBAND, THE UNIT SHALL REVERT TO THE MINIMUM OUTDOOR AIR MODE DESCRIBED ABOVE.

FREE COOLING MODE

FREE COOLING MODE SHALL BE ENABLED WHEN THE UNIT IS IN ECONOMIZER MODE AND THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT. DURING THE FREE COOLING MODE, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE MAXIMUM OUTDOOR AIR, EXHAUST AIR, AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. MINIMUM DISCHARGE AIR TEMPERATURE SHALL BE 55°F.

UNOCCUPIED HEATING AND COOLING MODES

WHEN INDEXED TO THE UNOCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE SUPPLY FAN SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

UPON A DROP IN SPACE TEMPERATURE OF 1°F BELOW THE 60°F (ADJUSTABLE) UNOCCUPIED HEATING SETPOINT OF THE NIGHT SETBACK TEMPERATURE SENSOR, THE UNIT SHALL OPERATE IN THE UNOCCUPIED HEATING MODE UNTIL THE SPACE TEMPERATURE RISES TO 3°F ABOVE THE UNOCCUPIED HEATING SETPOINT. IN THE UNOCCUPIED HEATING MODE, THE SUPPLY FAN SHALL BE ENERGIZED, THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F DISCHARGE AIR TEMPERATURE.

UPON A RISE IN SPACE TEMPERATURE OF 2°F ABOVE THE 85°F UNOCCUPIED COOLING SETPOINT OF THE NIGHT SETBACK TEMPERATURE SENSOR, THE UNIT SHALL OPERATE IN THE UNOCCUPIED COOLING MODE UNTIL THE SPACE TEMPERATURE DROPS TO 2°F BELOW THE UNOCCUPIED COOLING SETPOINT. IN THE UNOCCUPIED COOLING MODE, THE SUPPLY FAN SHALL BE ENERGIZED, THE COOLING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.

IF THE UNIT IS UNDER ECONOMIZER CONDITIONS AS DESCRIBED IN THE ENTHALPY ECONOMIZER SECTION, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL OPEN TO THEIR MAXIMUM POSITION, AND THE RETURN AIR DAMPER SHALL REMAIN CLOSED.

SUMMER DX OPERATION (FOR USE WHEN THE CHILLER IS OFF)

1. WHEN SUMMER DX OPERATION AND OCCUPIED OPERATION ARE INDEXED, THE AIR HANDLING UNIT SHALL OPERATE THE SAME AS NORMAL OPERATION, WITH THE EXCEPTION THAT COOLING CAPACITY SHALL BE MODULATED BY STAGING THE COMPRESSORS IN THE CONDENSING UNITS INSTEAD OF MODULATING THE POSITION OF THE CHILLED WATER COIL.

OPERATING SAFETY CONTROLS

OPERATING SAFETY CONTROLS SHALL BE HARD-WIRED THROUGH THE SUPPLY FAN VFD CONTROL CIRCUIT. THE SUPPLY AND RETURN AIR SMOKE DETECTORS AND LOW LIMIT TEMPERATURE SENSOR SHALL REQUIRE A MANUAL RESET FOR THE UNIT TO BE RESTARTED. THE DISCHARGE AIR STATIC PRESSURE SWITCH SHALL RESET AFTER A 15-MINUTE TIME DELAY.

WHEN THE SUPPLY OR RETURN AIR SMOKE DETECTOR DETECTS THE PRESENCE OF SMOKE, THE HEATING COIL DISCHARGE AIR TEMPERATURE DROPS BELOW 38°F, OR THE DISCHARGE AIR STATIC PRESSURE EXCEEDS 2.00" W.C. (ADJUSTABLE), THE SUPPLY AND RETURN FANS SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, THE HEATING COIL CONTROL VALVE SHALL OPEN, AND AN ALARM SHALL SIGNAL AT THE BAS. AN ALARM SHALL ALSO SIGNAL AT THE FIRE ALARM CONTROL PANEL FOR THE SUPPLY OR RETURN AIR SMOKE DETECTOR.

GENERAL NOTES:

1. THE NEW AHU CONTROLLERS SHALL BE EITHER JCI METASYS, HONEYWELL TRIDIUM OR SCHNEIDER ECOSTRUXURE.
2. ALL ATC WORK SHALL BE PERFORMED BY INSTALLERS AUTHORIZED BY THE BAS MANUFACTURER.
3. THE BAS CONTROLS SHALL UTILIZE ELECTRONIC SENSING, MICROPROCESSOR-BASED DIGITAL CONTROL. ALL EXISTING PNEUMATIC DAMPER ACTUATORS SHALL BE REPLACED WITH ELECTRONIC TYPE. ALL EXISTING PNEUMATIC VALVES SHALL REMAIN, PROVIDE E/P TRANSDUCERS TO ALLOW FOR MODULATION.
4. PROVIDE ANALOG PRESSURE TRANSDUCER TO CONVERT DDC VOLTAGE INTO PNEUMATIC SIGNAL PRESSURE FOR PNEUMATIC VALVES, EQUAL TO VERIS EP2100S.
5. PROVIDE PRESSURE SENSORS FOR DUCT SENSORS WITH APPROPRIATE RANGES, EQUAL TO SETRA MODEL 264.
6. THE ATC CONTRACTOR SHALL PROVIDE ALL CONTROLLERS; CONTROL DEVICES; CONTROL PANELS; SOFTWARE; PROGRAMMING; AND INPUT/OUTPUT, POWER, AND NETWORK WIRING REQUIRED TO CONTROL THE HVAC EQUIPMENT AND CONNECT THE HVAC EQUIPMENT TO THE BAS.
7. IF COMMUNICATION IS LOST BETWEEN THE UNIT CONTROLLER AND THE BAS, THE UNIT CONTROLLER SHALL OPERATE USING DEFAULT MODES AND SETPOINTS.
8. EXCEPT AS OTHERWISE INDICATED, PROVIDE MANUFACTURER'S STANDARD MATERIALS AND COMPONENTS AS PUBLISHED IN THEIR PRODUCT INFORMATION, DESIGNED AND CONSTRUCTED AS RECOMMENDED BY THE MANUFACTURER, AND AS REQUIRED FOR THE APPLICATION INDICATED.
9. ALL INPUT/OUTPUT POINTS SHOWN IN THE DDC POINT LISTS SHALL BE HARDWIRED TO THE BAS.
10. GRAPHICS SHALL BE PROVIDED ON THE BAS FOR ALL INPUT/OUTPUT POINTS SHOWN IN THE DDC POINT LISTS. GRAPHICS SHALL IDENTIFY THE CURRENT MODE OF OPERATION, SETPOINTS, AND CURRENT VALUES OF ALL POINTS. ALL SETPOINTS SHALL BE ADJUSTABLE.
11. OCCUPIED/UNOCCUPIED MODES OF OPERATION SHALL BE DETERMINED BY THE TIME SCHEDULE OF THE BAS.
12. ALL WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND SHALL BE INSTALLED WITHIN CONDUIT (EMT - INDOORS, RIGID STEEL - OUTDOORS) IN EXPOSED OR CONCEALED, INACCESSIBLE LOCATIONS. UL PLENUM RATED CABLE INSTALLED ON J-HOOKS IS ACCEPTABLE FOR CONCEALED, ACCESSIBLE LOCATIONS FOR COMMUNICATIONS AND SIGNAL WIRING. J-HOOKS SHALL BE PROVIDED AT INTERVALS NOT EXCEEDING 60 INCHES. CABLES SHALL BE SECURED WITH VELCRO CABLE STRAPS (PLASTIC CABLE TIES ARE NOT ACCEPTABLE). 24VAC POWER WIRING SHALL BE METAL CLAD (MC) CABLE AND SECURELY FASTENED.
13. COMMUNICATION WIRING:
    A. LOCAL SUPERVISORY LAN: CATEGORY 6 OF STANDARD TIA/EIA (100/1000BASET). NETWORK SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 30 VOLTS.
    B. PRIMARY AND SECONDARY CONTROLLER LANS: INDIVIDUALLY 100% SHIELDED PAIRS PER MANUFACTURER'S RECOMMENDATIONS FOR DISTANCES INSTALLED, WITH OVERALL PVC COVER, CLASS 2, PLENUM-RATED. COMMUNICATION WIRING SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 10 VOLTS. SHIELD SHALL BE TERMINATED AND WIRING SHALL BE GROUNDED AS RECOMMENDED BY BAS MANUFACTURER.
13. SIGNAL WIRING TO ALL FIELD DEVICES INCLUDING, BUT NOT LIMITED TO, ALL SENSORS, TRANSDUCERS, TRANSMITTERS, SWITCHES, ETC. SHALL BE TWISTED, 100% SHIELDED PAIR, MINIMUM 18-GAUGE WIRE, WITH PVC COVER. SIGNAL WIRING SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 30 VOLTS. SHIELD SHALL BE GROUNDED AT CONTROLLER END ONLY UNLESS OTHERWISE RECOMMENDED BY THE CONTROLLER MANUFACTURER.
14. FUNCTION OF CONTROLS SHALL BE AUTOMATICALLY RESTORED TO NORMAL OPERATION WITHOUT OPERATOR INTERVENTION WHEN SAFETIES ARE RESET OR WHEN POWER IS RESTORED AFTER AN OUTAGE. LOW LIMIT TEMPERATURE SENSORS AND HIGH LIMIT PRESSURE SWITCHES SHALL REQUIRE MANUAL RESET AT THEIR RESPECTIVE UNIT. EMERGENCY FAN SHUTDOWN SHALL BE RESET WHEN THE EMERGENCY POWER OFF SWITCH IS RESET. SMOKE DETECTOR TRIPPING SHALL BE RESET WHEN THE ALARM IS NO LONGER PRESENT IN THE FIRE ALARM SYSTEM.
15. PROVIDE AN UNITERRUPTIBLE POWER SUPPLY (UPS) FOR ALL SERVER-LEVEL BAS COMPONENTS.

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

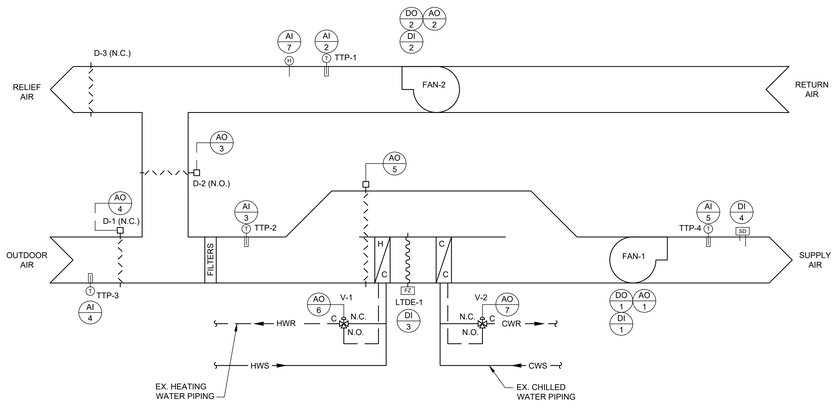
KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

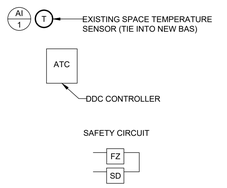
CONTROLS & SEQUENCE OF OPERATIONS

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	NONE
SHEET	M5.1



1 M5.2 AIR-HANDLING UNIT CONTROL DIAGRAM (AHU-2, AHU-4 & AHU-5)

NO SCALE



THE SAFETY CIRCUIT SHALL RUN THROUGH THE FREEZE STAT AND SMOKE DETECTOR. ON A SAFETY EVENT, THE HEATING WATER CONTROL VALVE SHALL OPEN, BOTH FANS SHALL DE-ENERGIZE, THE MIXED AIR DAMPER SHALL OPEN AND OUTSIDE AIR DAMPER SHALL CLOSE.

SEQUENCE OF OPERATION (AHU-2 & AHU-5)

GENERAL

THE AIR-HANDLING UNIT SHALL BE CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS) CONTROLLER FURNISHED AND FIELD-INSTALLED BY THE ATC CONTRACTOR.

VAV INTERLOCK

THE EXISTING INTERLOCK WITH THE PNEUMATIC VAV BOXES SHALL BE RETAINED, TO ALLOW FOR THE VAV BOXES TO OPERATE ON THE SAME OCCUPIED SCHEDULE AS THE CORRESPONDING AIR-HANDLING UNIT.

SMOKE DAMPER CONTROL

DUCT SMOKE DETECTORS SHALL BE SUPPLIED WITH CONTROL MAIN AIR FROM AN EP SWITCH ENERGIZED BY THE SUPPLY FAN STARTER. END SWITCHES SHALL BE NORMALLY OPEN AND WIRED IN SERIES TO KEEP THE SUPPLY FAN DEENERGIZED UNTIL THE SMOKE DAMPERS ARE FULLY OPEN.

FAN SPEED CONTROL

WHEN ENERGIZED, THE SUPPLY FAN VORTEX DAMPER SHALL MODULATE TO MAINTAIN THE STATIC PRESSURE SETPOINT OF THE SUPPLY AIR STATIC PRESSURE SENSOR. THE RETURN FAN VORTEX DAMPER SHALL TRACK THE SUPPLY FAN WITH AN ADJUSTABLE OFFSET SET BY THE TEST AND BALANCE CONTRACTOR.

MECHANICAL COOLING CAPACITY CONTROL

THE MECHANICAL COOLING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY OPENING THE CHILLED WATER COIL CONTROL VALVE TO THE COIL, AND USING THE FACE & BYPASS DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.

HEATING CAPACITY CONTROL

THE HEATING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY OPENING THE HEATING WATER COIL CONTROL VALVE TO THE COIL, AND USING THE FACE & BYPASS DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.

MORNING WARM-UP/COOL-DOWN MODE

WHEN INDEXED TO THE OCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE UNIT SHALL BE PLACED IN EITHER THE WARM-UP OR COOL-DOWN MODE WHEN THE RETURN AIR TEMPERATURE IS BELOW 68°F. THE UNIT SHALL BE PLACED IN THE WARM-UP MODE; WHEN THE RETURN AIR TEMPERATURE IS ABOVE 68°F, THE UNIT SHALL BE PLACED IN THE COOL-DOWN MODE.

IN BOTH THE WARM-UP AND COOL-DOWN MODES, THE SUPPLY FAN SHALL BE ENERGIZED AND RUN CONTINUOUSLY, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

IN THE WARM-UP MODE, THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE. THE WARM-UP MODE SHALL CONTINUE UNTIL THE RETURN AIR TEMPERATURE REACHES 68°F. IN THE COOL-DOWN MODE, THE COOLING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN THE 55°F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE SETPOINT. THE COOL-DOWN MODE SHALL CONTINUE UNTIL THE RETURN AIR TEMPERATURE REACHES 76°F.

OCCUPIED MODE

WHEN THE WARM-UP/COOL-DOWN MODE IS COMPLETED, THE SUPPLY AND RETURN FANS SHALL OPERATE AS DESCRIBED IN THE FAN SPEED CONTROL SECTION ABOVE. THE MINIMUM OUTDOOR AIR AND RETURN AIR DAMPERS SHALL POSITION TO PROVIDE MINIMUM OUTDOOR AIRFLOW. THE EXHAUST AIR DAMPER SHALL BE CLOSED.

MINIMUM OUTDOOR AIR MODE

THE DISCHARGE AIR TEMPERATURE SHALL BE RESET BASED ON THE RETURN AIR TEMPERATURE AS FOLLOWS:

A. DISCHARGE AIR TEMPERATURE SHALL BE 55°F WHEN THE RETURN AIR TEMPERATURE IS 72°F OR HIGHER.

B. DISCHARGE AIR TEMPERATURE SHALL BE 62°F WHEN THE RETURN AIR TEMPERATURE IS LOWER THAN 72°F.

UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE SETPOINT, MECHANICAL COOLING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE MECHANICAL COOLING CAPACITY CONTROL SECTION ABOVE.

UPON A DROP IN DISCHARGE AIR TEMPERATURE BELOW SETPOINT, HEATING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE HEATING CAPACITY CONTROL SECTION ABOVE.

FOR AHU-4 ONLY: THE OUTSIDE AIR DAMPER POSITION SHALL HAVE TWO POSITIONS: LOW: 1,000 CFM, AND NORMAL: 4,500 CFM. A SCHEDULE MATCHING THE EXISTING TIME CLOCK SHALL CONTROL LOW AND NORMAL ACCORDING TO EXISTING SCHEDULE ESTABLISHED BY THE HCPSS. MANUAL OVERRIDE SHALL PUT DAMPER IN LOW POSITION. NEW DAMPER POSITIONS SHALL MATCH EXISTING.

UPON A DROP IN MIXED AIR TEMPERATURE BELOW 38°F, THE OUTDOOR AIR DAMPER SHALL MODULATE CLOSED AND THE RETURN AIR DAMPER SHALL MODULATE OPEN. THE MIXED AIR TEMPERATURE LOW LIMIT CONTROL SHALL CONTINUE WITH A 2°F DEADBAND.

ENTHALPY ECONOMIZER MODE

ECONOMIZER MODE SHALL BE ENABLED WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR WHEN THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F. IF THE UNIT IS NOT IN THE FREE COOLING MODE DURING ECONOMIZER MODE, THE MAXIMUM OUTDOOR AIR DAMPER AND EXHAUST AIR DAMPER SHALL BE FULLY OPENED, AND THE RETURN AIR DAMPER SHALL BE CLOSED. MECHANICAL COOLING SHALL NOT BE LOCKED OUT.

UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE SETPOINT, MECHANICAL COOLING SHALL BE ENABLED AND ITS CAPACITY SHALL BE CONTROLLED AS DESCRIBED IN THE MECHANICAL COOLING CAPACITY CONTROL SECTION ABOVE.

IF THE OUTDOOR AIR ENTHALPY RISES ABOVE THE RETURN AIR ENTHALPY WITH A 3 BTU/LB DEADBAND, THE UNIT SHALL REVERT TO THE MINIMUM OUTDOOR AIR MODE DESCRIBED ABOVE.

FREE COOLING MODE

FREE COOLING MODE SHALL BE ENABLED WHEN THE UNIT IS IN ECONOMIZER MODE AND THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT. DURING THE FREE COOLING MODE, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE MAXIMUM OUTDOOR AIR, EXHAUST AIR, AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. MINIMUM DISCHARGE AIR TEMPERATURE SHALL BE 55°F.

UNOCCUPIED HEATING AND COOLING MODES

WHEN INDEXED TO THE UNOCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE SUPPLY FAN SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

UPON A DROP IN SPACE TEMPERATURE OF 1°F BELOW THE 60°F (ADJUSTABLE) UNOCCUPIED HEATING SETPOINT OF THE NIGHT SETBACK TEMPERATURE SENSOR, THE UNIT SHALL OPERATE IN THE UNOCCUPIED HEATING MODE UNTIL THE SPACE TEMPERATURE RISES TO 3°F ABOVE THE UNOCCUPIED HEATING SETPOINT. IN THE UNOCCUPIED HEATING MODE, THE SUPPLY FAN SHALL BE ENERGIZED, THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F DISCHARGE AIR TEMPERATURE.

UPON A RISE IN SPACE TEMPERATURE OF 2°F ABOVE THE 85°F UNOCCUPIED COOLING SETPOINT OF THE NIGHT SETBACK TEMPERATURE SENSOR, THE UNIT SHALL OPERATE IN THE UNOCCUPIED COOLING MODE UNTIL THE SPACE TEMPERATURE DROPS TO 2°F BELOW THE UNOCCUPIED COOLING SETPOINT. IN THE UNOCCUPIED COOLING MODE, THE SUPPLY FAN SHALL BE ENERGIZED, THE COOLING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.

IF THE UNIT IS UNDER ECONOMIZER CONDITIONS AS DESCRIBED IN THE ENTHALPY ECONOMIZER SECTION, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL OPEN TO THEIR MAXIMUM POSITION, AND THE RETURN AIR DAMPER SHALL REMAIN CLOSED.

OPERATING SAFETY CONTROLS

OPERATING SAFETY CONTROLS SHALL BE HARD-WIRED THROUGH THE SUPPLY FAN VFD CONTROL CIRCUIT. THE SUPPLY AND RETURN AIR SMOKE DETECTORS AND LOW LIMIT TEMPERATURE SENSOR SHALL REQUIRE A MANUAL RESET FOR THE UNIT TO BE RESTARTED. THE DISCHARGE AIR STATIC PRESSURE SWITCH SHALL RESET AFTER A 15-MINUTE TIME DELAY.

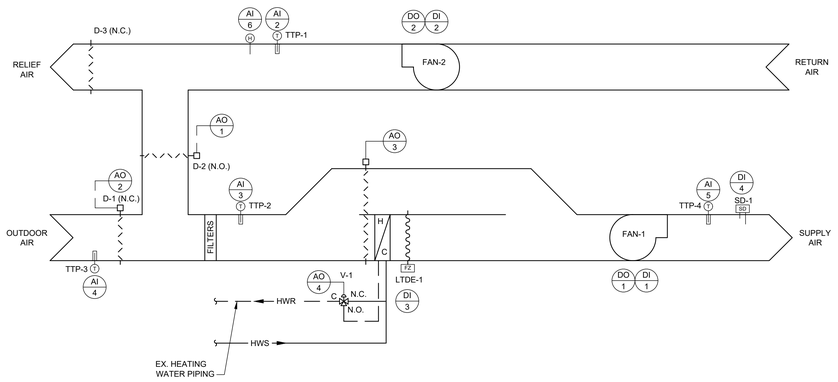
WHEN THE SUPPLY OR RETURN AIR SMOKE DETECTOR DETECTS THE PRESENCE OF SMOKE, THE HEATING COIL DISCHARGE AIR TEMPERATURE DROPS BELOW 38°F, OR THE DISCHARGE AIR STATIC PRESSURE EXCEEDS 2.00" W.C. (ADJUSTABLE), THE SUPPLY AND RETURN FANS SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, THE HEATING COIL CONTROL VALVE SHALL OPEN, AND AN ALARM SHALL SIGNAL AT THE BAS. AN ALARM SHALL ALSO SIGNAL AT THE FIRE ALARM CONTROL PANEL FOR THE SUPPLY OR RETURN AIR SMOKE DETECTOR.

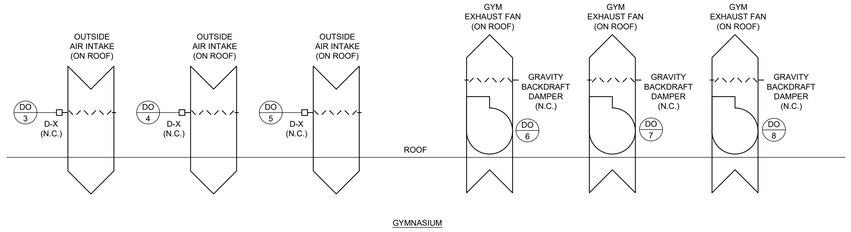
DDC POINT LIST (AHU-2,5)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
ANALOG INPUT	AI-1	ZONE TEMPERATURE SENSORS (TYP OF 2)	TREND	NEW	
	AI-2	RETURN AIR TEMPERATURE	TREND	NEW	
	AI-3	MIXED AIR TEMPERATURE	TREND	NEW	
	AI-4	OUTDOOR AIR TEMPERATURE	TREND	NEW	
	AI-5	SUPPLY AIR TEMPERATURE	TREND	NEW	
	AI-6	2/3 DUCT STATIC PRESSURE	TREND	NEW	
	AI-7	RETURN AIR HUMIDITY	TREND	NEW	
DIGITAL INPUT	DI-1	SUPPLY FAN STATUS	TREND	NEW	1
	DI-2	RETURN FAN STATUS	TREND	NEW	1
	DI-3	FREEZE STAT STATUS	TREND	NEW	2
	DI-4	SMOKE DETECTOR STATUS	TREND	NEW	2
ANALOG OUTPUT	AO-1	SUPPLY FAN VORTEX DAMPER	TREND	NEW	
	AO-2	RETURN FAN VORTEX DAMPER	TREND	NEW	
	AO-3	MIXED AIR DAMPER	TREND	NEW	
	AO-4	OUTDOOR AIR DAMPER	TREND	NEW	
	AO-5	FACE/BYPASS DAMPER	TREND	NEW	
	AO-6	COOLING COIL VALVE	TREND	NEW	
	AO-7	HEATING COIL VALVE	TREND	NEW	
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND	NEW	
	DO-2	RETURN FAN START/STOP	TREND	NEW	

NOTE 1: ISSUE VIRTUAL ALARM IF STATUS DOES NOT MATCH COMMAND AFTER 30 SECONDS.

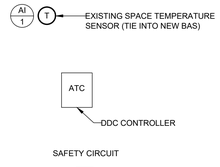
NOTE 2: ISSUE DIAL OUT ALARM IF SAFETY IS ACTIVE.





2 M5.2 AIR-HANDLING UNIT CONTROL DIAGRAM (AHU-3)

NO SCALE



THE SAFETY CIRCUIT SHALL RUN THROUGH THE FREEZE STAT AND SMOKE DETECTOR. ON A SAFETY EVENT, THE HEATING WATER CONTROL VALVE SHALL OPEN, BOTH FANS SHALL DE-ENERGIZE, THE MIXED AIR DAMPER SHALL OPEN AND OUTSIDE AIR DAMPER SHALL CLOSE.

SEQUENCE OF OPERATION (AHU-3)

GENERAL

THE AIR-HANDLING UNIT SHALL BE CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS) CONTROLLER FURNISHED AND FIELD-INSTALLED BY THE ATC CONTRACTOR.

SMOKE DAMPER CONTROL

DUCT SMOKE DETECTORS SHALL BE SUPPLIED WITH CONTROL MAIN AIR FROM AN EP SWITCH ENERGIZED BY THE SUPPLY FAN STARTER. END SWITCHES SHALL BE NORMALLY OPEN AND WIRED IN SERIES TO KEEP THE SUPPLY FAN DEENERGIZED UNTIL THE SMOKE DAMPERS ARE FULLY OPEN.

MECHANICAL VENTILATION CONTROL

IN MECHANICAL VENTILATION MODE (WHEN THE UNIT IS INDEXED TO OCCUPIED AND THE PLANT SWITCH IS IN SUMMER MODE), THE UNIT SHALL OPEN THE OUTDOOR AND EXHAUST AIR DAMPERS TO THEIR MAXIMUM POSITION, THE HEATING WATER COIL CONTROL VALVE SHALL SHUT TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL BYPASS THE COIL.

HEATING CAPACITY CONTROL

IN MECHANICAL HEATING MODE (WHEN THE UNIT IS INDEXED TO OCCUPIED AND THE PLANT SWITCH IS IN WINTER MODE) THE HEATING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY OPENING THE HEATING WATER COIL CONTROL VALVE TO THE COIL, AND USING THE FACE & BYPASS DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. THE RETURN AIR DAMPER SHALL BE AT MAXIMUM POSITION, AND THE OUTSIDE/EXHAUST AIR DAMPERS SHALL BE AT MINIMUM POSITION.

MORNING WARM-UP

WHEN INDEXED TO THE OCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE UNIT SHALL BE PLACED IN THE WARM-UP MODE WHEN THE RETURN AIR TEMPERATURE IS BELOW 68°F.

THE SUPPLY FAN SHALL BE ENERGIZED AND RUN CONTINUOUSLY, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE. THE WARM-UP MODE SHALL CONTINUE UNTIL THE RETURN AIR TEMPERATURE REACHES 68°F.

OCCUPIED MODE

WHEN THE WARM-UP MODE IS COMPLETED, THE SUPPLY AND RETURN FANS SHALL BE ENERGIZED. THE MINIMUM OUTDOOR AIR AND RETURN AIR DAMPERS SHALL POSITION AS DESCRIBED IN THE HEATING OR MECHANICAL VENTILATION MODE AS APPLICABLE. THE EXHAUST AIR DAMPER SHALL BE CLOSED.

UNOCCUPIED HEATING MODE

WHEN INDEXED TO THE UNOCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE SUPPLY AND RETURN FANS SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN.

UPON A DROP IN SPACE TEMPERATURE OF 1°F BELOW THE 60°F (ADJUSTABLE) UNOCCUPIED HEATING SETPOINT OF THE NIGHT SETBACK TEMPERATURE SENSOR, THE UNIT SHALL OPERATE IN THE UNOCCUPIED HEATING MODE UNTIL THE SPACE TEMPERATURE RISES TO 3°F ABOVE THE UNOCCUPIED HEATING SETPOINT. IN THE UNOCCUPIED HEATING MODE, THE SUPPLY FAN SHALL BE ENERGIZED, THE HEATING COIL CONTROL VALVE SHALL OPEN TO THE COIL, AND THE FACE & BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 90°F DISCHARGE AIR TEMPERATURE.

OPERATING SAFETY CONTROLS

OPERATING SAFETY CONTROLS SHALL BE HARD-WIRED THROUGH THE SUPPLY FAN CONTROL CIRCUIT. THE SUPPLY AND RETURN AIR SMOKE DETECTORS AND LOW LIMIT TEMPERATURE SENSOR SHALL REQUIRE A MANUAL RESET FOR THE UNIT TO BE RESTARTED.

WHEN THE SUPPLY OR RETURN AIR SMOKE DETECTOR DETECTS THE PRESENCE OF SMOKE, OR THE HEATING COIL DISCHARGE AIR TEMPERATURE DROPS BELOW 38°F, THE SUPPLY AND RETURN FANS SHALL BE DEENERGIZED, THE OUTDOOR AIR AND EXHAUST AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, THE HEATING COIL CONTROL VALVE SHALL OPEN, AND AN ALARM SHALL SIGNAL AT THE BAS. AN ALARM SHALL ALSO SIGNAL AT THE FIRE ALARM CONTROL PANEL FOR THE SUPPLY OR RETURN AIR SMOKE DETECTOR.

MANUAL MODE

A 6 HOUR WALL TIMER SWITCH TMR-1, LOCATED IN THE GYM OFFICE, SHALL ENERGIZE THE SYSTEM. WALL TIMER SHALL ONLY ENERGIZE THE SYSTEM IF THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 50 °F. IT SHALL TURN ON THE THREE GYM EXHAUST FANS AND CONTROL AHU-3 IN THE MECHANICAL VENTILATION MODE OF OPERATION. ONCE THE EXHAUST FANS ARE ENERGIZED, THE GYM OUTSIDE AIR DAMPERS SHALL OPEN FULLY.

DDC POINT LIST (AHU-3)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
ANALOG INPUT	AI-1	ZONE TEMPERATURE SENSORS (TYP OF 1)	TREND	NEW	
	AI-2	RETURN AIR TEMPERATURE	TREND	NEW	
	AI-3	MIXED AIR TEMPERATURE	TREND	NEW	
	AI-4	OUTDOOR AIR TEMPERATURE	TREND	NEW	
	AI-5	DISCHARGE AIR TEMPERATURE			
	AI-6	RETURN AIR HUMIDITY	TREND	NEW	
DIGITAL INPUT	DI-1	SUPPLY FAN STATUS	TREND	NEW	1
	DI-2	RETURN FAN STATUS	TREND	NEW	1
	DI-3	FREEZE STAT STATUS	TREND	NEW	2
	DI-4	SMOKE DETECTOR STATUS	TREND	NEW	2
ANALOG OUTPUT	AO-1	MIXED AIR DAMPER	TREND	NEW	
	AO-2	OUTDOOR AIR DAMPER	TREND	NEW	
	AO-3	FACE/BYPASS DAMPER	TREND	NEW	
	AO-4	HEATING COIL VALVE	TREND	NEW	
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND	NEW	
	DO-2	RETURN FAN START/STOP	TREND	NEW	
	DO-3	OA INTAKE 1	TREND	NEW	
	DO-4	OA INTAKE 2	TREND	NEW	
	DO-5	OA INTAKE 3	TREND	NEW	
	DO-6	EX FAN START/STOP 1	TREND	NEW	
	DO-7	EX FAN START/STOP 2	TREND	NEW	
	DO-8	EX FAN START/STOP 3	TREND	NEW	

NOTE 1: ISSUE VIRTUAL ALARM IF STATUS DOES NOT MATCH COMMAND AFTER 30 SECONDS.

NOTE 2: ISSUE DIAL OUT ALARM IF SAFETY IS ACTIVE.

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

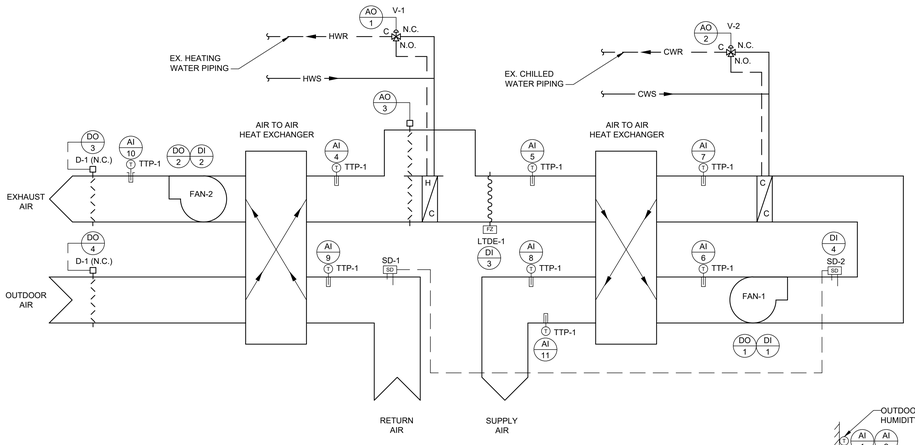
NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

CONTROLS & SEQUENCE OF OPERATIONS

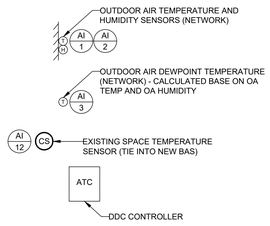
DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	NONE
SHEET	

M5.2



1 M5.3 OUTDOOR AIR-HANDLING UNIT CONTROL DIAGRAM (OA-AHU-1 & OA-AHU-2)

NO SCALE



THE SAFETY CIRCUIT SHALL RUN THROUGH THE FREEZE STAT AND SMOKE DETECTOR. ON A SAFETY EVENT, THE HEATING WATER CONTROL VALVE SHALL OPEN, BOTH FANS SHALL DE-ENERGIZE, THE MIXED AIR DAMPER SHALL OPEN AND OUTSIDE AIR DAMPER SHALL CLOSE.

SEQUENCE OF OPERATION (OA-AHU-1 & OA-AHU-2)

GENERAL

THE DEDICATED OUTDOOR AIR SYSTEM (DOAS) UNIT SHALL BE CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS) CONTROLLER FURNISHED AND FIELD-INSTALLED BY THE ATC CONTRACTOR.

OUTDOOR AIR DEWPOINT SHALL BE CALCULATED BASED ON THE OUTDOOR AIR TEMPERATURE AND OUTDOOR AIR RELATIVE HUMIDITY. SUPPLY AIR DEWPOINT SHALL BE OBTAINED BY THE SUPPLY AIR DEWPOINT SENSOR.

THE SUPPLY AND EXHAUST FANS SHALL BE ENERGIZED AND RUN CONTINUOUSLY DURING THE NORMAL OCCUPIED MODES OF OPERATION.

DISCHARGE AIR TEMPERATURE RESET SCHEDULE

THE DISCHARGE AIR TEMPERATURE SHALL BE RESET BASED ON THE FOLLOWING SCHEDULE:

OUTDOOR AIR TEMPERATURE	DISCHARGE AIR TEMPERATURE
10°F - 60°F	85°F - 75°F
60°F - 70°F	75°F - 70°F
70°F - 95°F	70°F - 55°F

OCCUPIED HEATING MODE

THE UNIT SHALL OPERATE IN THE HEATING MODE WHEN THE OUTDOOR AIR DEWPOINT IS LESS THAN 50°F AND THE OUTDOOR AIR TEMPERATURE IS 70°F OR LESS.

THE HEATING CAPACITY OF THE UNIT SHALL BE CONTROLLED BY MODULATING THE HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. WHEN HEATING IS REQUIRED, THE FACE AND BYPASS DAMPERS SHALL BE POSITIONED FULLY OPENED TO THE COIL FACE. WHEN HEATING IS NOT REQUIRED, THE FACE AND BYPASS DAMPERS SHALL BE POSITIONED TO FULL BYPASS.

OCCUPIED COOLING MODE

THE UNIT SHALL OPERATE IN THE COOLING MODE WHEN THE OUTDOOR AIR DEWPOINT IS LESS THAN 50°F AND THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 70°F.

THE CHILLED WATER COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.

OCCUPIED DEHUMIDIFICATION MODE

THE UNIT SHALL OPERATE IN THE DEHUMIDIFICATION MODE WHENEVER THE OUTDOOR AIR DEWPOINT IS GREATER THAN 50°F.

THE CHILLED WATER COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F COOLING COIL LEAVING AIR TEMPERATURE.

UNOCCUPIED MODE

WHEN INDEXED TO THE UNOCCUPIED MODE BY THE TIME SCHEDULE OF THE BAS, THE SUPPLY AND EXHAUST FANS SHALL BE DE-ENERGIZED AND THE OUTDOOR AND EXHAUST AIR DAMPERS SHALL CLOSE.

FAN FAILURE ALARM

A FAN FAILURE ALARM SHALL SIGNAL AT THE BAS WHEN EITHER THE SUPPLY OR EXHAUST FAN FAILS TO OPERATE WHEN COMMANDED TO DO SO.

DISCHARGE AIR DEWPOINT ALARM

A HIGH DISCHARGE AIR DEWPOINT ALARM SHALL SIGNAL AT THE BAS WHEN THE DISCHARGE AIR DEWPOINT IS GREATER THAN THE 55°F SETPOINT OF THE DISCHARGE AIR DEWPOINT SENSOR.

OPERATING SAFETY CONTROLS

OPERATING SAFETY CONTROLS SHALL BE HARD-WIRED THROUGH THE SUPPLY AND EXHAUST FAN CONTROL CIRCUITS. THE SUPPLY AND EXHAUST AIR SMOKE DETECTORS AND LOW LIMIT TEMPERATURE SENSOR SHALL REQUIRE A MANUAL RESET FOR THE UNIT TO BE RESTARTED.

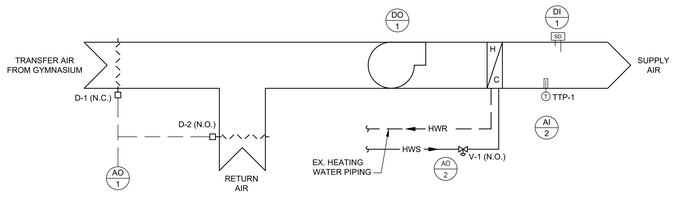
WHEN THE SUPPLY OR EXHAUST AIR DUCT SMOKE DETECTOR DETECTS THE PRESENCE OF SMOKE OR THE HEATING COIL DISCHARGE AIR TEMPERATURE DROPS BELOW 38°F, THE SUPPLY AND EXHAUST FANS SHALL BE DE-ENERGIZED, THE OUTDOOR AND EXHAUST AIR DAMPERS SHALL CLOSE, AND AN ALARM SHALL SIGNAL AT THE BAS. AN ALARM SHALL ALSO SIGNAL AT THE FIRE ALARM CONTROL PANEL FOR THE SUPPLY OR EXHAUST AIR SMOKE DETECTOR. THE DUCT SMOKE DETECTORS SHALL REQUIRE A MANUAL RESET FOR THE UNIT TO BE RESTARTED.

DDC POINT LIST (OA-AHU-1 & OA-AHU-2)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
ANALOG INPUT	AI-1	OUTDOOR AIR TEMPERATURE (NETWORK)	TREND	NEW	
	AI-2	OUTDOOR AIR HUMIDITY (NETWORK)	TREND	NEW	
	AI-3	OUTDOOR AIR DEWPOINT (NETWORK) - CALCULATED	TREND	NEW	
	AI-4	POST 1ST HEAT EXCHANGER TEMPERATURE	TREND	NEW	
	AI-5	HEATING COIL DISCHARGE TEMPERATURE	TREND	NEW	
	AI-6	POST 2ND HEAT EXCHANGER TEMPERATURE	TREND	NEW	
	AI-7	COOLING COIL DISCHARGE TEMPERATURE	TREND	NEW	
	AI-8	SUPPLY AIR TEMPERATURE	TREND	NEW	
	AI-9	RETURN AIR TEMPERATURE	TREND	NEW	
	AI-10	EXHAUST AIR TEMPERATURE	TREND	NEW	
	AI-11	SUPPLY AIR DEWPOINT TEMPERATURE	TREND	NEW	
	AI-12	ZONE TEMPERATURE SENSOR (TYP OF 4)	TREND	NEW	
DIGITAL INPUT	DI-1	SUPPLY FAN STATUS	TREND	NEW	1
	DI-2	RETURN FAN STATUS	TREND	NEW	1
	DI-3	FREEZE STAT STATUS	TREND	NEW	2
	DI-4	SMOKE DETECTOR STATUS	TREND	NEW	2
ANALOG OUTPUT	AO-1	HEATING COIL VALVE	TREND	NEW	
	AO-2	COOLING COIL VALVE	TREND	NEW	
	AO-3	FACE/BYPASS DAMPER	TREND	NEW	
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND	NEW	
	DO-2	RETURN FAN START/STOP	TREND	NEW	
	DO-3	EXHAUST AIR DAMPER	TREND	NEW	
	DO-4	OUTSIDE AIR DAMPER	TREND	NEW	

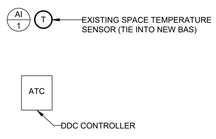
NOTE 1: ISSUE VIRTUAL ALARM IF STATUS DOES NOT MATCH COMMAND AFTER 30 SECONDS.

NOTE 2: ISSUE DIAL OUT ALARM IF SAFETY IS ACTIVE.



2 M5.3 H & V UNIT (LOCKER ROOMS)

NO SCALE



SEQUENCE OF OPERATIONS (H & V UNIT)

GENERAL:

UNIT FAN SHALL BE INTERLOCKED TO START WITH THE GYMNASIUM AIR-HANDLING UNIT (AHU-3).

SMOKE DETECTION:

DUCT SMOKE DETECTOR LOCATED AT FAN DISCHARGE, SHALL BE WIRED IN SERIES WITH THE SUPPLY FAN STARTER SUCH THAT THE SMOKE DETECTOR SHALL, WHEN IT SENSES PRODUCTS OF COMBUSTION, DEACTIVATE THE SUPPLY FAN.

OCCUPIED MODE:

WHEN THE UNIT IS INDEXED TO OCCUPIED MODE, THE RETURN AIR DAMPER (N.O.) SHALL BE CLOSED, THE TRANSFER AIR DAMPER (N.C.) SHALL OPEN, THE UNIT FAN SHALL START AND ROOM THERMOSTAT, THROUGH DISCHARGE TEMPERATURE CONTROLLER, SHALL MODULATE HEATING CONTROL VALVE TO MAINTAIN ITS SETPOINT OF 75 °F.

UNOCCPIED MODE:

WHEN THE UNIT IS INDEXED TO UNOCCUPIED MODE THE UNIT FAN SHALL STOP AND ALL DAMPERS SHALL REMAIN IN THEIR NORMAL POSITION. WHEN ANY ZONE TEMPERATURE FALLS BELOW 65°F. THE FAN SHALL TURN ON AND THE HEATING COIL VALVE SHALL OPEN UNTIL THE ZONE IS ABOVE 67°F, UPON WHICH IT WILL RESUME UNOCCUPIED MODE.

DDC POINT LIST (H&V UNITS)

POINT TYPE	POINT #	DESCRIPTION	FUNCTIONS	POINT TYPE	NOTE
ANALOG INPUT	AI-1	ZONE TEMPERATURE SENSORS	TREND		
	AI-2	SUPPLY AIR TEMPERATURE	TREND		
DIGITAL INPUT	DI-1	SUPPLY FAN STATUS	TREND		1
	DI-2	SMOKE DETECTOR STATUS	TREND		2
ANALOG OUTPUT	AO-1	RETURN AIR DAMPER	TREND		
	AO-2	HEATING COIL VALVE	TREND		
DIGITAL OUTPUT	DO-1	SUPPLY FAN START/STOP	TREND		

NOTE 1: ISSUE VIRTUAL ALARM IF STATUS DOES NOT MATCH COMMAND AFTER 30 SECONDS.

NOTE 2: ISSUE DIAL OUT ALARM IF SAFETY IS ACTIVE.

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

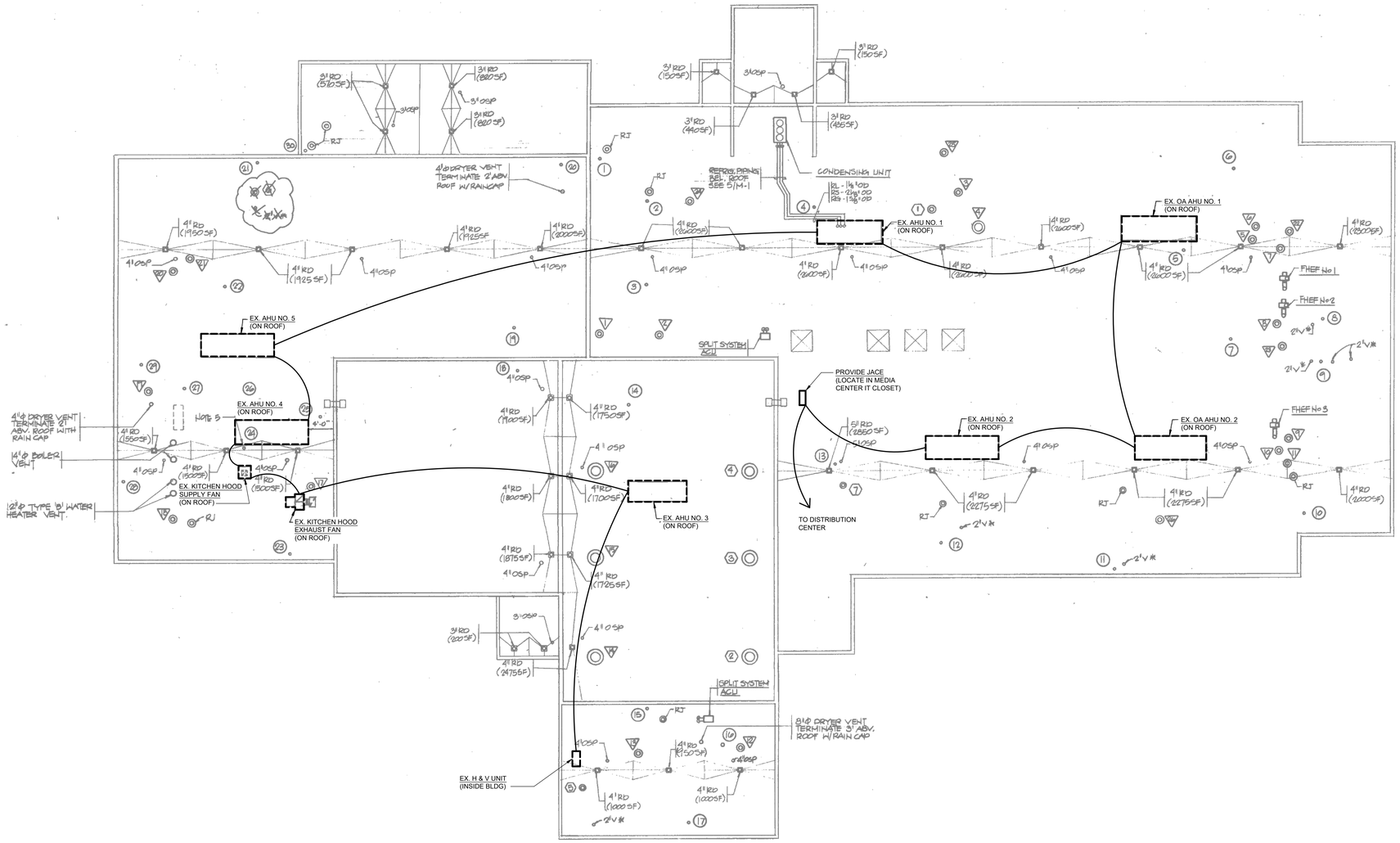
DRAWING

CONTROLS & SEQUENCE OF OPERATIONS

DRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	NONE

SHEET

M5.3



1 M5.4 NETWORK WIRING SCHEMATIC

NO SCALE

Howard County Public School System

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 44890, expiration date 01/08/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

CONTROLS, SEQUENCE OF OPERATIONS & NETWORK WIRING SCHEMATIC

GRAWN BY	LOWE
CHECKED BY	LUCAS
PROJECT NO.	202302
SCALE	NONE

SHEET

M5.4

NOT ALL SYMBOLS INDICATED HERE MAY APPEAR ON THE CONTRACT DRAWINGS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
$	SINGLE POLE SWITCH		208 VOLT PANELBOARD
$3	THREE WAY SWITCH		480 VOLT PANELBOARD
$M	MANUAL MOTOR STARTER WITH THERMAL OVERLOAD AND HOA SWITCH	B	BELL
$K	KEY SWITCH	S	SPEAKER, WALL MOUNTED
$4	4 WAY SWITCH	S	SPEAKER, CEILING MOUNTED
M	MOTION SENSOR	PS	PAGING SYSTEM SPEAKER, WALL MOUNTED
	DUPLEX RECEPTACLE ◇1	PC	PAGING SYSTEM CALL SWITCH
	DUPLEX RECEPTACLE MOUNTED ABOVE COUNTER ABOVE BACKSPLASH	T T	THERMOSTAT
	DOUBLE DUPLEX RECEPTACLE	P	PHOTOCELL
	SPECIAL RECEPTACLE, SIZE AND TYPE AS NOTED ◇1	H	H-O-A SWITCH
WP	WP RECEPTACLE		PUSH BUTTON
G	GFCI DUPLEX RECEPTACLE	FCU	FAN COIL UNIT
	FLOOR RECEPTACLE, FLUSH WITH FLOOR	SV	SOLENOID VALVE
	RECEPTACLE ABOVE CEILING	CUH	CABINET UNIT HEATER
WC	DUPLEX RECEPTACLE FOR ELECTRIC WATER COOLER	ER	EMERGENCY BYPASS CONTROL RELAY
	CLOCK OUTLET	L	ELECTRIC DOOR LOCK
a b	LIGHTING FIXTURE WITH DOUBLE BALLAST	D	DOOR CONTACT
	LIGHTING FIXTURE		FUSE
	LIGHTING FIXTURE ON EMERGENCY CIRCUIT		FUSED SWITCH
	WALL MOUNTED FIXTURE		SWITCH AND FUSE
	INDUSTRIAL TYPE FIXTURE		CIRCUIT BREAKER
	CEILING MOUNTED DOWN LIGHT	J	JUNCTION BOX
	WALL MOUNTED LIGHTING FIXTURE	G	GENERATOR
	WALL WASH/DOWN LIGHT, CEILING MOUNTED		MOTOR CONNECTION
	WALL SCONCE		UNIT HEATER CONNECTION
	COVE FIXTURE. LENGTH AS SHOWN ON DRAWINGS		SAFETY SWITCH NON-FUSED, SIZE AS INDICATED
	TRACK LIGHT WITH FIXTURE	F	SAFETY SWITCH FUSED, SIZE AS INDICATED
	POLE MOUNTED LIGHTING LUMINAIRE (S), LANDSCAPE FIXTURE		ELECTRICAL DEVICE AS INDICATED
	EXIT LIGHT BACK MOUNTED & w/ DIRECTIONAL CHEVRONS AS INDICATED		COMBINATION TYPE MOTOR STARTER, SIZE AS INDICATED
	EXIT LIGHT TOP OR PENDANT MOUNTED, SINGLE FACE WITH DIRECTIONAL CHEVRONS AS INDICATED		TRANSFORMER, SIZE AS INDICATED
	EXIT LIGHT TOP OR PENDANT MOUNTED, DOUBLE FACE WITH DIRECTIONAL CHEVRONS AS INDICATED	TC	TIME CLOCK
	GROUND ROD	R	RELAY
	AIR TERMINAL	S	SURFACE MOUNTED RACEWAY
P	FIRE ALARM SYSTEM MANUAL PULL STATION	E	UNDERGROUND ELECTRICAL LINES, AS NOTED
	FIRE ALARM SYSTEM HEAT DETECTOR	T	UNDERGROUND COMMUNICATION LINES, AS NOTED
	FIRE ALARM SYSTEM, VISUAL LIGHT/STROBE		CONDUIT, CONCEALED IN CEILING OR WALL OR CHASE
	FIRE ALARM SYSTEM COMBINATION HORN AND LIGHT		CONDUIT CONCEALED IN FLOOR OR UNDER FLOOR UNDERGROUND
	FIRE ALARM SYSTEM HORN	CR	CARD READER
	FIRE ALARM SYSTEM SMOKE DETECTOR	KP	KEY PAD
◇1 , D	FIRE ALARM SYSTEM DUCT SMOKE DETECTOR	WH	WATER HEATER
x , S-x	FIRE ALARM SYSTEM MAGNETIC DOOR HOLDER		
, FS	FIRE ALARM SYSTEM FLOW SWITCH		
, TS	FIRE ALARM SWITCH TAMPER SWITCH		
FCP	FIRE ALARM CONTROL PANEL		
FSA	FIRE ALARM ANNUNCIATOR PANEL		
	RACEWAY UP		
	RACEWAY DOWN		
	EMERGENCY MUSHROOM PUSH BUTTON (E-STOP)		

SPECIAL NOTE

◇1 IF ANY SUFFIX ADDED: G INDICATES GFCI, D INDICATES DEDICATED WP INDICATES WEATHERPROOF, R INDICATES RECESSED, S INDICATES SURFACE MOUNTED, AND XP INDICATES EXPLOSION PROOF

NOT ALL ABBREVIATIONS INDICATED HERE MAY APPEAR ON THE CONTRACT DRAWINGS

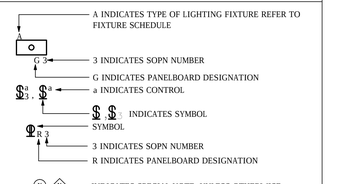
ABBREV	DESCRIPTION	ABBREV	DESCRIPTION
A, AMP	AMPERES	JB	JUNCTION BOX
ABBREV	ABBREVIATIONS	KV	KILOVOLT
AC	ALTERNATING CURRENT	KVA	KILOVOLT-AMPERE
ACU	AIR CONDITIONING UNIT	KW	KILOWATT
AF	AMPERE FRAME	KWH	KILOWATT-HOUR
AFF	ABOVE FINISHED FLOOR	LS	LIMIT SWITCH
AFG	ABOVE FINISHED GRADE	LTG	LIGHTING
AHU	AIR HANDLING UNIT	LV	LOW VOLTAGE
AIC	AMPERE INTERRUPTING CAPACITY	MAX	MAXIMUM
ATC	AUTOMATIC TEMPERATURE CONTROL	MCB	MAIN CIRCUIT BREAKER
ATS	AUTOMATIC TRANSFER SWITCH	MCC	MOTOR CONTROL CENTER
AUX	AUXILIARY	MCP	MOTOR CIRCUIT PROTECTOR
AWG	AMERICAN WIRE GAUGE	MH	MOUNTING HEIGHT
BES	BUILDING ELECTRICAL SYSTEM	MIN	MINIMUM
BIL	BASIC IMPULSE LEVEL	MDP	MAIN DISTRIBUTION PANEL
BLDG	BUILDING	MCM	THOUSAND CIRCULAR MILLS
BKBD	BACKBOARD	MTD	MOUNTED
BRKR	BREAKER	MLO	MAIN LUGS ONLY
C	CONDUIT	MTG	MOUNTING
CB	CIRCUIT BREAKER	N	NEUTRAL
CCTV	CLOSED CIRCUIT TELEVISION	NC	NORMALLY CLOSED
CKT	CIRCUIT	NEC	NATIONAL ELECTRICAL CODE
CR	CARD READER	NIC	NOT-IN-CONTRACT
CL	CURRENT LIMITING	NL	NIGHT LIGHT
CLG	CEILING	NO	NORMALLY OPEN
CPT	CONTROL POWER TRANSFORMER	NTS	NOT TO SCALE
CT	CURRENT TRANSFORMER	NFSS	NON-FUSED SAFETY SWITCH
CUH	CABINET UNIT HEATER	OC	ON CENTER
CW	COOL WHITE	OH	OVERHEAD
DGS	DIESEL GENERATOR SET	OL	OVERLOAD
DIA	DIAMETER	P	POLE OR POLES
DISC	DISCONNECT	PF	POWER FACTOR
DIST	DISTRIBUTION	PH	PHASE
DN	DOWN	PT	POTENTIAL TRANSFORMER
DP	DISTRIBUTION PANEL	PNL	PANELBOARD
DS	DISCONNECT SWITCH	PVC	POLYVINYL CHLORIDE
DWG	DRAWING	R	RACEWAY
E	EMERGENCY	RAF	RETURN AIR FAN
EBH	ELECTRIC BASEBOARD HEATER	RECEPT	RECEPTACLE
EC	EMPTY CONDUIT	REQD	REQUIRED
ECB	ENCLOSED CIRCUIT BREAKER	RGS	RIGID GALVANIZED STEEL
EF	EXHAUST FAN	RMS	ROOT MEAN SQUARE
EGS	ELECTRIC GENERATOR SET	RS	RAPID START
EH	ELECTRIC HEATER	RVAT	REDUCED VOLTAGE
ELECT	ELECTRICAL		AUTOTRANSFORMER
EMT	ELECTRICAL METALLIC TUBING	S/N	SOLID NEUTRAL
ENCL	ENCLOSURE	SD	SMOKE DETECTOR
EQUIP	EQUIPMENT	SEC	SECONDARY
ER	EXISTING RELOCATED	SFA	SPRINKLER FLOW ALARM
ETR	EXISTING-TO-REMAIN	SMR	SURFACE METAL RACEWAY
EWC	ELECTRIC WATER COOLER	SPEC	SPECIFICATION
EWH	ELECTRIC WATER HEATER	ST	SHUNT TRIP
EX	EXISTING	SS	SUB STATION
EXH	EXHAUST	STR	STARTER
F	FUSED OR FUSIBLE	SW	SWITCH
FA	FRAME AMPERE	SWBD	SWITCHBOARD
FAAP	FIRE ALARM ANNUNCIATOR PANEL	SWGR	SWITCHGEAR
FACP	FIRE ALARM CONTROL PANEL	SYS	SYSTEM
FADS	FIRE ALARM AND DETECTION SYSTEM	SYM	SYMMETRICAL
FBO	FURNISHED BY OTHERS	SOPN	SPACE OR POLE NUMBER
FCU	FAN COIL UNIT	TA	TRIP AMPERE
FDR	FEEDER	TB	TERMINAL BOX
FL	FLOOR	TC	TIME CLOCK
FLUOR	FLUORESCENT	TD	TIME DELAY
FSS	FUSED SAFETY SWITCH	TTB	TELEPHONE TERMINAL BOARD
FT	FOOT OR FEET	TTC	TELEPHONE TERMINAL CLOSET
GFCI, GFI	GROUND FAULT CIRCUIT INTERRUPTER	TYP	TYPICAL
GN	GENERAL NOTE	TV	TELEVISION
GND	GROUND	UC	UNDER COUNTER
GRS	GALVANIZED RIGID STEEL	UG	UNDERGROUND
GWB	GYPSUM WALL BOARD	UH	UNIT HEATER
GW	GROUND WIRE	UOI	UNLESS OTHERWISE INDICATED
HC	HANDICAP	UON	UNLESS OTHERWISE NOTED
HD	HEAVY DUTY	UL	UNDERWRITER'S LABORATORY
HID	HIGH INTENSIFY DISCHARGE	V	VOLT (S) OR VOLTAGE
HOA	HAND-OFF-AUTOMATIC	VA	VOLT AMPERE
HP	HORSE POWER	W	WIRE
HTR	HEATER	W/	WITH
HV	HIGH VOLTAGE	WP	WEATHER PROOF
HVAC	HEATING, VENTILATING AND AIR CONDITIONING	WW	WIREWAY
		W/O	WITHOUT
HZ	HERTZ	XFMR	TRANSFORMER
IE	THAT IS		

NOTE: UNLESS OTHERWISE INDICATED, STANDARD MOUNTING HEIGHTS FOR OUTLET BOXES FOR THE FOLLOWING EQUIPMENT/DEVICE SHALL BE ABOVE FINISHED FLOOR AND SHALL BE TO THE CENTER LINE OF EQUIPMENT

EQUIPMENT/DEVICE	MOUNTING HEIGHT
SWITCHES	48 INCH
RECEPTACLE-GENERAL	18 INCH
RECEPTACLE-SPECIAL	18 INCH
RECEPTACLE-SINGLE	18 INCH
RECEPTACLE-REST ROOM	9 INCH ABOVE BASIN
RECEPTACLE-COUNTER	9 INCH ABOVE COUNTER
RECEPTACLE-EXTERIOR	30 INCH
TELEPHONE-GENERAL	18 INCH
TELEPHONE-WALL TYPE	54 INCH, (48 INCH FOR HANDICAPPED)
FIRE ALARM PULL STATION	48 INCH
FIRE ALARM AUDIO/VISUAL DEVICE	96 INCH
CARD READER	42 INCH
THERMOSTAT	60 INCH
EXIT LIGHT WALL MOUNTED	MAX 90 INCH
SAFETY SWITCH	72 INCH TO HANDLE
PANELBOARD	72 INCH TO TOP CB
MANUAL MOTOR STARTER	48 INCH
PUSH BUTTON	48 INCH

NOT ALL CONVENTIONS INDICATED HERE MAY APPEAR ON THE CONTRACT DRAWINGS

CONVENTIONS



A INDICATES TYPE OF LIGHTING FIXTURE REFER TO FIXTURE SCHEDULE

3 INDICATES SOPN NUMBER

G INDICATES PANELBOARD DESIGNATION

a INDICATES CONTROL

INDICATES SYMBOL SYMBOL

3 INDICATES SOPN NUMBER

R INDICATES PANELBOARD DESIGNATION

INDICATES SPECIAL NOTE. UNLESS OTHERWISE NOTED, DRAWING NOTE APPLIES ONLY TO THE DRAWING ON WHICH IT APPEARS.

ELECTRICAL GENERAL NOTES ARE APPLY TO ALL DRAWINGS, UNLESS OTHERWISE NOTED.

HOME RUN TO PANELBOARD DISTRIBUTION EQUIPMENT AS INDICATED.

2,4 NUMBERS INDICATE SOPN NUMBER FOR PANEL

R INDICATES THE PANEL

CROSS HATCH LINES INDICATE THE NUMBER OF CURRENT CARRYING CONDUCTORS (SIZE AS INDICATED IN PANELBOARD SCHEDULE).

CROSS HATCH LINES WITH DOT AT END INDICATES THE EQUIPMENT GROUNDING CONDUCTOR (GREEN WIRE) AND SHALL BE SIZED IN ACCORDANCE WITH NEC ARTICLE 250. GREEN GROUNDING WIRE SHALL BE PROVIDED WITH EACH CIRCUIT, AND/OR FEEDER. WHERE NO WIRES ARE INDICATED, PROVIDE 2 (TWO) CURRENT CARRYING # 12 AWG CONDUCTORS AND 1 (ONE) # 12 GROUND WIRE FOR BRANCH CIRCUIT WIRING IN 3/4" RACEWAY UNLESS OTHERWISE INDICATED.

ELECTRICAL GENERAL NOTES

EGN-1 REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATIONS MECHANICAL EQUIPMENT AND DEVICES.

EGN-2 ELECTRICAL EQUIPMENT IS SPECIFIED BY MAKE AND MODEL NUMBER TO ESTABLISH A LEVEL OF QUALITY, DIMENSIONAL LIMITATIONS, AND PERFORMANCE CHARACTERISTICS UNLESS OTHERWISE NOTED. PRODUCTS OF OTHER MANUFACTURERS MAY BE FURNISHED. HOWEVER THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE SAME OR BETTER LEVEL OF QUALITY; DIMENSIONAL LIMITATIONS; AND PERFORMANCE CHARACTERISTICS.

EGN-3 UNLESS OTHERWISE NOTED, ALL WORK IN FINISHED OCCUPIED AREAS SHALL BE CONCEALED ABOVE CEILING, IN WALL AND/OR IN CHASES. ALL RACEWAYS IN BOILER ROOM AND PENTHOUSE SHALL BE EXPOSED.

EGN-4 ALL MATERIAL AND EQUIPMENT SHALL BE U.L. LISTED AS SUITABLE FOR THE LOCATION AND ENVIRONMENT FOR WHICH IT IS USED AND SHALL MEET MCPS REQUIREMENTS.

EGN-5 ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF NEC AND ALL OTHER APPLICABLE CODES.

EGN-6 ALL EQUIPMENT AND WIRING THAT MAY REQUIRE SERVICING SHALL BE COMPLETELY ACCESSIBLE UPON COMPLETION OF PROJECT. JUNCTION BOXES AND PULL BOXES SHALL BE INSTALLED WHEREVER REQUIRED FOR A COMPLETE INSTALLATION OF BUILDING ELECTRICAL SYSTEMS. SIZE IN ACCORDANCE WITH NEC.

EGN-7 THE CONTRACTOR SHALL COORDINATE WITH ALL OTHER TRADES/CONTRACTORS FOR A COMPLETE INSTALLATION OF WORK.

EGN-8 THE CONTRACTOR SHALL THOROUGHLY EXAMINE THE PREMISES AND OBSERVE ALL FIELD CONDITIONS UNDER WHICH THE WORK SHALL BE PERFORMED. CONTRACTOR SHALL VERIFY LOCATION OF ALL EQUIPMENT WITH OTHER TRADES AND OWNER, REQUIRING ELECTRICAL CONNECTIONS, BEFORE ANY ROUGH-IN. ANY DIFFICULTIES IN COMPLYING WITH THE DRAWINGS AND SPECIFICATIONS SHALL BE BROUGHT TO THE ATTENTION OF OWNER BEFORE BIDDING.

EGN-9 PROVIDE GROUNDING CONNECTIONS FOR ALL ENCLOSURES, DEVICES AND EQUIPMENT PERMANENTLY AND EFFECTIVELY IN ACCORDANCE WITH NEC AND PROJECT SPECIFICATIONS. PROVIDE GROUNDING CONDUCTOR WITH EACH BRANCH CIRCUIT.

EGN-10 EACH PENETRATION THROUGH WALLS, CEILINGS AND FLOORS SHALL BE SEALED IN ACCORDANCE WITH ALL APPLICABLE CODES, AND PROJECT SPECIFICATIONS. SEALANT SHALL BE COMPATIBLE WITH WALL, FLOOR AND ROOF CONSTRUCTION AND/OR THEIR ASSOCIATED FIRE RATINGS IN ACCORDANCE WITH IBC AND NFPA.

EGN-11 UNLESS OTHERWISE NOTED, ALL WIRING CONDUCTORS SHALL BE COPPER, TYPE THWN/THHN INSULATION, RATED FOR 90 DEGREE C. AND IN METALLIC RACEWAYS.

EGN-12 DRAWINGS ARE DIAGRAMMATIC AND ARE INTENDED TO INDICATE THE GENERAL ARRANGEMENT. THEY ARE NOT INTENDED TO SHOW ALL DETAILS OF CONSTRUCTION OR EXACT LOCATIONS OF THE WORK.

EGN-13 ALL OVERCURRENT PROTECTION DEVICES USED FOR MECHANICAL EQUIPMENT PROTECTION SHALL BE HACR RATED. CONTRACTOR SHALL VERIFY WIRE SIZES, C/B AND FUSE RATINGS FOR ALL HVAC EQUIPMENT, AND BRING TO THE ATTENTION OF THE ARCHITECT ANY DISCREPANCIES AFFECTING THE WORK PRIOR TO PROCEEDING.

EGN-14 THE CORRECT NUMBER OF WIRES MAY NOT BE INDICATED FOR ALL CIRCUITS. PROVIDE ALL WIRES NECESSARY FOR THE PROPER FUNCTION OF THE SYSTEM WHETHER INDICATED ON DRAWINGS OR NOT.

EGN-15 CONDUCTORS SHALL BE INSTALLED CONTINUOUS BETWEEN DEVICES, WITH SPLICES LOCATED ONLY IN JUNCTION BOXES OR IN CABINETS. CONDUCTORS SHALL BE OF SUFFICIENT LENGTH TO REACH THE FARTHEST TERMINAL IN PANELS. A MINIMUM OF 6" LOOPS SHALL REMAIN WHERE CONNECTIONS OR TAPS ARE TO BE MADE IN BRANCH CIRCUIT WIRING.

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 18652, expiration date 04/04/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

ELECTRICAL LEGEND AND GENERAL NOTES

DRAWN BY	PG
CHECKED BY	PG
PROJECT NO.	202302
SCALE	NONE
SHEET	

E1.0

SPECIAL NOTES

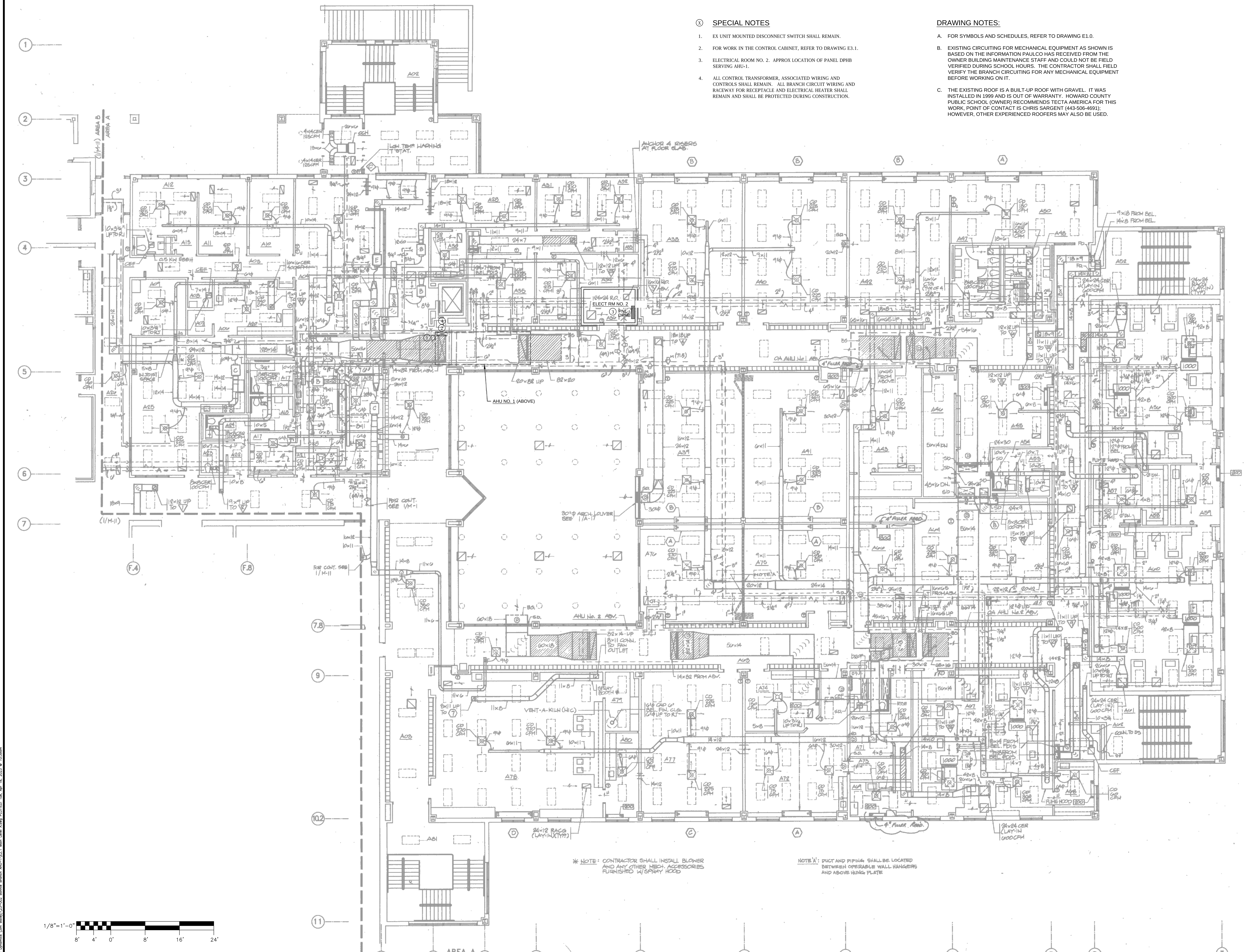
1. EX UNIT MOUNTED DISCONNECT SWITCH SHALL REMAIN.
2. FOR WORK IN THE CONTROL CABINET, REFER TO DRAWING E3.1.
3. ELECTRICAL ROOM NO. 2. APPROX LOCATION OF PANEL DPHB SERVING AHU-1.
4. ALL CONTROL TRANSFORMER, ASSOCIATED WIRING AND CONTROLS SHALL REMAIN. ALL BRANCH CIRCUIT WIRING AND RACEWAY FOR RECEPTACLE AND ELECTRICAL HEATER SHALL REMAIN AND SHALL BE PROTECTED DURING CONSTRUCTION.

DRAWING NOTES:

A. FOR SYMBOLS AND SCHEDULES, REFER TO DRAWING E1.0.

B. EXISTING CIRCUITING FOR MECHANICAL EQUIPMENT AS SHOWN IS BASED ON THE INFORMATION PAULCO HAS RECEIVED FROM THE OWNER BUILDING MAINTENANCE STAFF AND COULD NOT BE FIELD VERIFIED DURING SCHOOL HOURS. THE CONTRACTOR SHALL FIELD VERIFY THE BRANCH CIRCUITING FOR ANY MECHANICAL EQUIPMENT BEFORE WORKING ON IT.

C. THE EXISTING ROOF IS A BUILT-UP ROOF WITH GRAVEL. IT WAS INSTALLED IN 1999 AND IS OUT OF WARRANTY. HOWARD COUNTY PUBLIC SCHOOL (OWNER) RECOMMENDS TECTA AMERICA FOR THIS WORK, POINT OF CONTACT IS CHRIS SARGENT (443-506-4691); HOWEVER, OTHER EXPERIENCED ROOFERS MAY ALSO BE USED.



MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL -DEMOTION WORK (1)
SCALE: 1/8" = 1' - 0"

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 18652, expiration date 04/04/2024.

CONSULTANTS

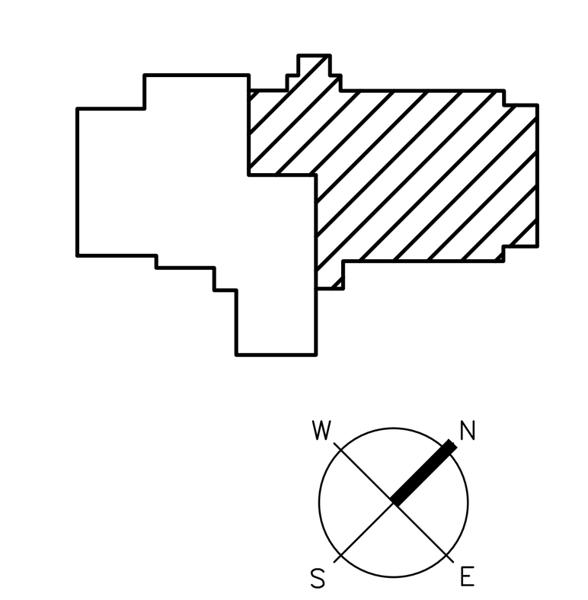
MECHANICAL ENGINEERS
Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS
PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

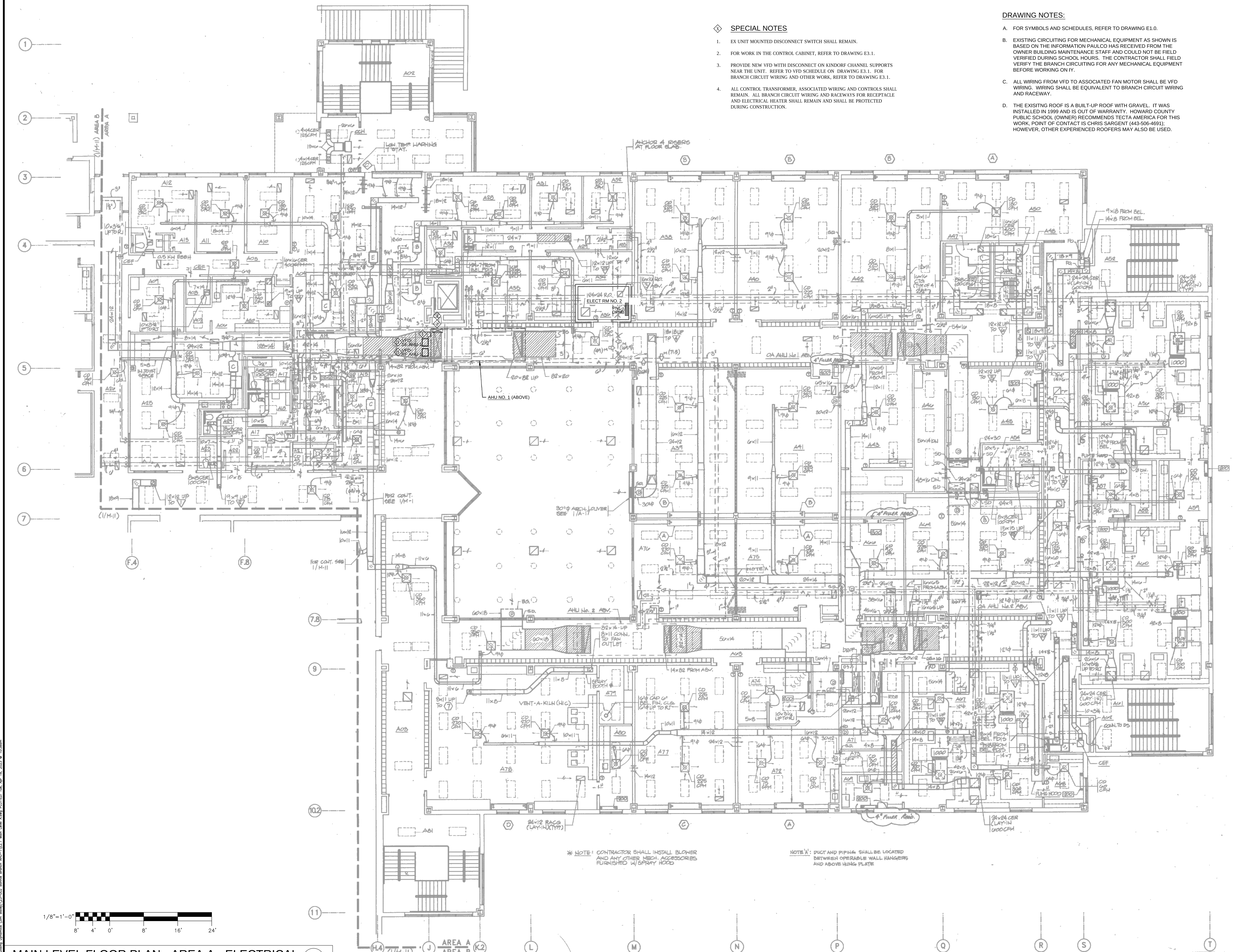


NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL - DEMOTION WORK

DRAWN BY	PG
CHECKED BY	PG
PROJECT NO.	202302
SCALE	1/8"=1'-0"
SHEET	E2.1



SPECIAL NOTES

1. EX UNIT MOUNTED DISCONNECT SWITCH SHALL REMAIN.
2. FOR WORK IN THE CONTROL CABINET, REFER TO DRAWING E3.1.
3. PROVIDE NEW VFD WITH DISCONNECT ON KINDORF CHANNEL SUPPORTS NEAR THE UNIT. REFER TO VFD SCHEDULE ON DRAWING E3.1. FOR BRANCH CIRCUIT WIRING AND OTHER WORK, REFER TO DRAWING E3.1.
4. ALL CONTROL TRANSFORMER, ASSOCIATED WIRING AND CONTROLS SHALL REMAIN. ALL BRANCH CIRCUIT WIRING AND RACEWAYS FOR RECEPTACLE AND ELECTRICAL HEATER SHALL REMAIN AND SHALL BE PROTECTED DURING CONSTRUCTION.

DRAWING NOTES:

A. FOR SYMBOLS AND SCHEDULES, REFER TO DRAWING E1.0.

B. EXISTING CIRCUITING FOR MECHANICAL EQUIPMENT AS SHOWN IS BASED ON THE INFORMATION PAULCO HAS RECEIVED FROM THE OWNER BUILDING MAINTENANCE STAFF AND COULD NOT BE FIELD VERIFIED DURING SCHOOL HOURS. THE CONTRACTOR SHALL FIELD VERIFY THE BRANCH CIRCUITING FOR ANY MECHANICAL EQUIPMENT BEFORE WORKING ON IY.

C. ALL WIRING FROM VFD TO ASSOCIATED FAN MOTOR SHALL BE VFD WIRING. WIRING SHALL BE EQUIVALENT TO BRANCH CIRCUIT WIRING AND RACEWAY.

D. THE EXISITNG ROOF IS A BUILT-UP ROOF WITH GRAVEL. IT WAS INSTALLED IN 1999 AND IS OUT OF WARRANTY. HOWARD COUNTY PUBLIC SCHOOL (OWNER) RECOMMENDS TECTA AMERICA FOR THIS WORK, POINT OF CONTACT IS CHRIS SARGENT (443-506-4691); HOWEVER, OTHER EXPERIENCED ROOFERS MAY ALSO BE USED.

MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL -NEW WORK (1)
SCALE: 1/8" = 1' - 0"

Howard County Public School System
Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 18652, expiration date 04/04/2024.

CONSULTANTS

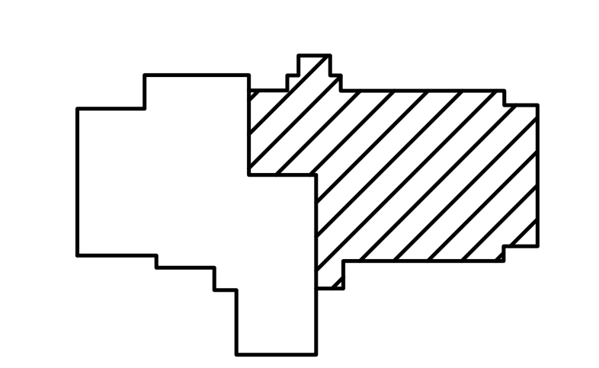
MECHANICAL ENGINEERS
Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS
PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN



NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

MAIN LEVEL FLOOR PLAN - AREA A - ELECTRICAL - NEW WORK

DRAWN BY	PG
CHECKED BY	PG
PROJECT NO.	202302
SCALE	1/8"=1'-0"
SHEET	

E2.2

PANELBOARD: DPHB	BUS RATING: 600 AMP	MAIN O.C. DEVICE OR MLO: MLO	
MINIMUM AIC: -	VOLTS: 480Y/277	PHASE (S): 3	WIRES: 4+1GW
ENCL. NEMA: 1	MOUNTING: SURFACE	BRANCH CIRCUIT DEVICE: CIRCUIT BREAKER	
LOCATION: ELECTRICAL ROOM 2	NOTES: EX SIEMENS MAKE CATALOG S4E75ML600ETS PANEL		

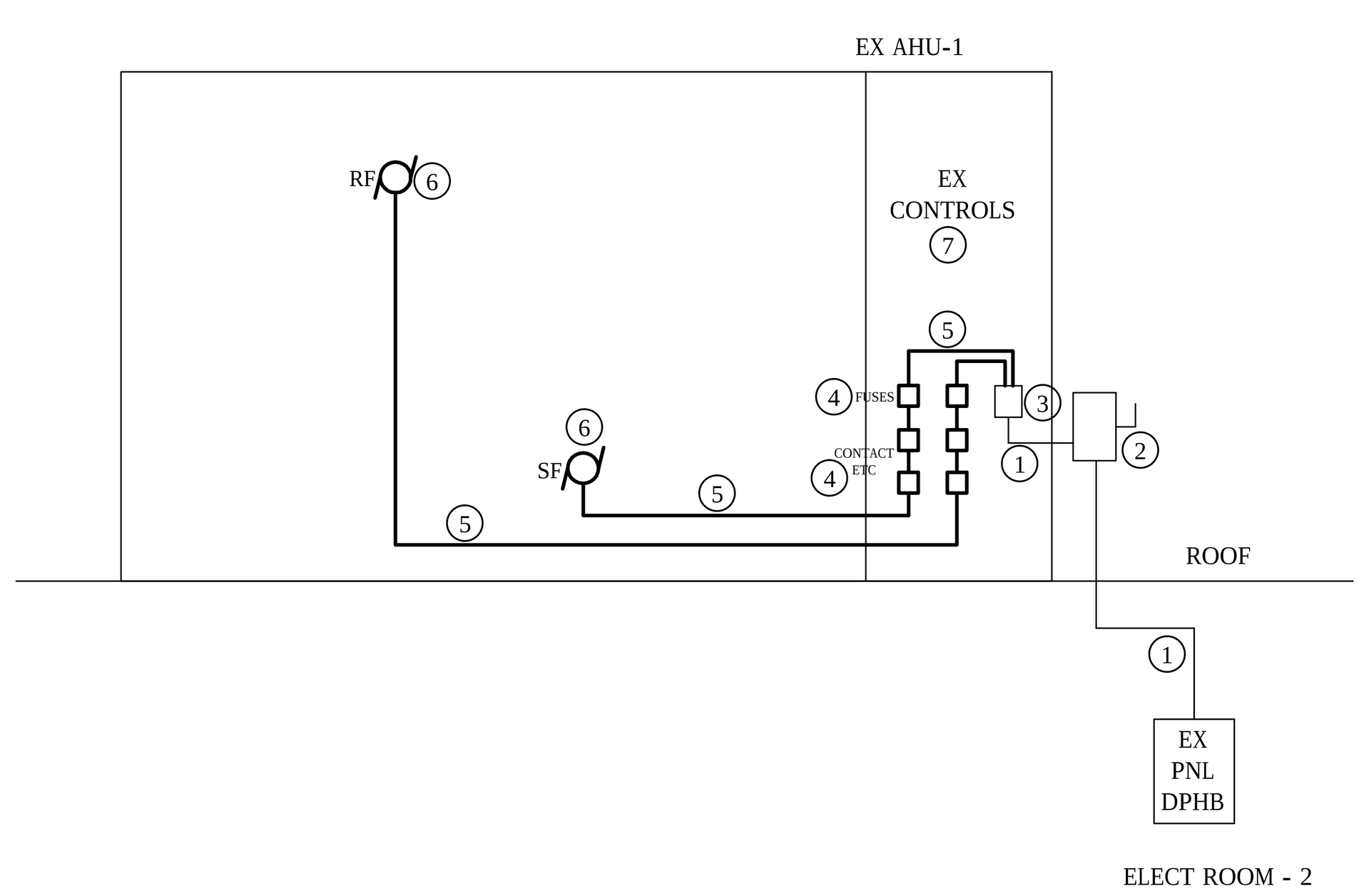
ITEM DESCRIPTION	WIRES	GND	C	CB P	CB TA	CKT	BUS A B C	CKT	CB P	CB TA	WIRES	GND	C	ITEM DESCRIPTION
	EX 300 AMP TRANSFORMER													
	EX 200 AMP PANEL HB													
EX SPACE	-	-	-	3	-	1	- -	2	3	-	-	-	-	EX SPACE
	-	-	-				- -				-	-	-	
	-	-	-				- -				-	-	-	
EX AHU#1	-	-	-	3	30	3	- -	4	3	20	-	-	-	EX USED
	-	-	-				- -				-	-	-	
	-	-	-				- -				-	-	-	
EX SPACE	-	-	-	3	-	5	- -	6	3	20	-	-	-	EX USED
	-	-	-				- -				-	-	-	
	-	-	-				- -				-	-	-	
EX ELEVATOR	-	-	-	3	40	7	- -	8	3	-	-	-	-	EX SPACE
	-	-	-				- -				-	-	-	
	-	-	-				- -				-	-	-	

VFD Schedule

VFD Tag	Servicing	Motor Data Qty	Phase	Volts	FLA	HP	Enclosure Rating	Harmonic Mitigation	Disconnect	Bypass	VFD Isolation Switch	VFD Min. SCCR	Basis of Design	Notes
VFD-SF1	SF AHU-1	1	3	460V	14	10	UL Type 3R	5% Impedance	Circuit Breaker	FVNR (Box Style)	Yes	100 KA	ABB ACH580	1,2,3,4,5,6,7,8,9,10,11,
VFD-RF1	RFAHU-1	1	3	460V	3.4	2	UL Type 3R	5% Impedance	Circuit Breaker	FVNR (Box Style)	Yes	100 KA	ABB ACH580	1,2,3,4,5,6,7,8,9,10,11,

Notes:

1. At minimum, VFD shall include 5% impedance via 5% AC line reactor or dual DC bus chokes sized to 5% equivalent impedance.
2. Provide UL1449 surge suppression device.
3. VFD shall include alpha-numeric keypad interface, with display in plain English. (Displays relying solely on codes are not acceptable).
4. Provide internal EMI/RFI filter per IEC 61800-3. VFD input Amps shall not exceed VFD output Amps.
5. VFD shall be BTL Listed for BACnet MS/TP, and also include Modbus and N2.
6. VFD shall include real time clock with battery backup (include 10 year battery).
7. Phase Loss Protection & Broken Belt (loss of load) indication while in Bypass.
8. Bypass Contactors shall be powered by Switch Mode Power supply, allowing +30% to -30% Input Voltage Tolerance. (120 V CPT not allowed).
9. VFD and Bypass shall both include BACnet MS/TP, Damper Control and Fireman's override functionality.
10. Bypass operation to auto-reset after a brown out condition.
11 Bypass shall be fully functional in the event of a VFD failure. Bypass shall not rely on the VFD.

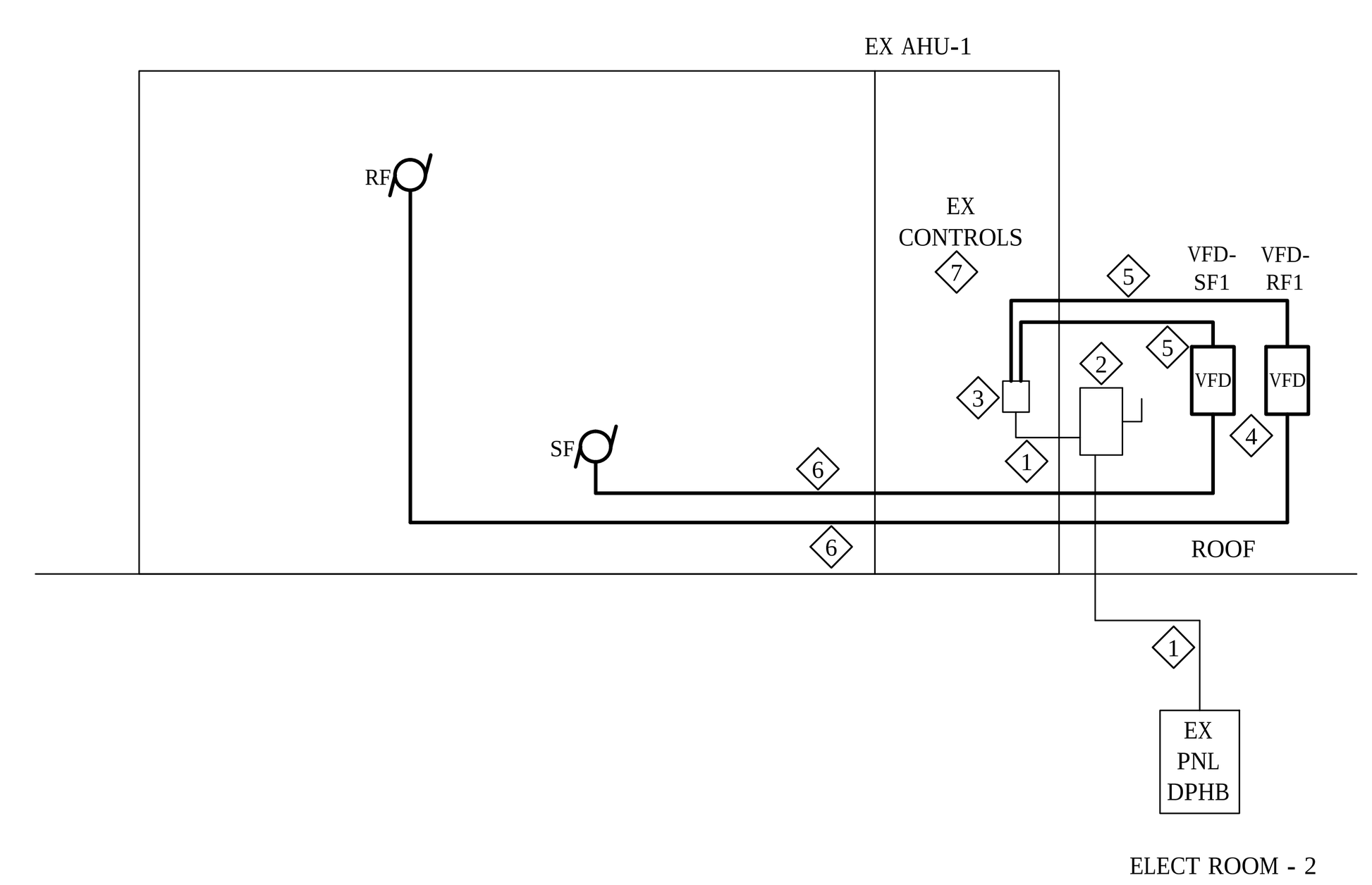


ONE LINE DIAGRAM - AHU-1 - DEMO WORK

NOT TO SCALE

(X) SPECIAL NOTES

1. EX BRANCH CIRCUIT WIRING AND RACEWAY SHALL REMAIN.
2. EX UNIT MOUNTED DISCONNECT SWITCH SHALL REMAIN.
3. EX LUGS BLOCK SHALL REMAIN.
4. DISCONNECT AND REMOVE FUSES, CONTACT, OVERLOAD ETC AND ASSOCIATED WIRING BETWEEN THEM (TYP OF 2).
5. DISCONNECT AND REMOVE EXISTING WIRING.
6. MOTOR TO BE REPLACED UNDER MECHANICAL. REFER TO MECHANICAL DRAWINGS.
7. ALL CONTROL TRANSFORMER, ASSOCIATED WIRING AND CONTROLS SHALL REMAIN. ALL BRANCH CIRCUIT WIRING AND RACEWAYS FOR RECEPTACLE AND ELECTRICAL HEATER SHALL REMAIN AND SHALL BE PROTECTED DURING CONSTRUCTION.



ONE LINE DIAGRAM - AHU-1 - NEW WORK

NOT TO SCALE

◇X SPECIAL NOTES

1. EX BRANCH CIRCUIT WIRING AND RACEWAY SHALL REMAIN.
2. EX UNIT MOUNTED DISCONNECT SWITCH SHALL REMAIN.
3. EX LUGS BLOCK SHALL REMAIN.
4. PROVIDE NEW VFD WITH DISCONNECT ON KINDORF CHANNEL SUPPORTS NEAR THE UNIT. REFER TO VFD SCHEDULE ON THIS DRAWING.
5. PROVIDE 3#10 AWG AND 1#10 GROUND WIRE - 3/4" RACEWAY.
6. PROVIDE VFD RATED CABLE (3#12 AWG AND 1#12 GROUND WIRE) IN 3/4" RACEWAY.
7. ALL CONTROL TRANSFORMER, ASSOCIATED WIRING AND CONTROLS SHALL REMAIN. ALL BRANCH CIRCUIT WIRING AND RACEWAYS FOR RECEPTACLE AND ELECTRICAL HEATER SHALL REMAIN AND SHALL BE PROTECTED DURING CONSTRUCTION.

FILE NAME: X:\Building Dynamics (Jim Bailey)\23-002 Bonnie Branch AHU-1\Legend and Schedules.dwg PLOTTED: Wed, Mar 29, 2023 @ 8:17pm

Howard County Public School System
9020 Mendenhall Court
Columbia, MD 21045

SEAL

Professional Certification. I certify that these documents were prepared or approved by me, and that I am a duly licensed engineer under the laws of the State of Maryland, License Number 18652, expiration date 04/04/2024.

CONSULTANTS

MECHANICAL ENGINEERS

Building Dynamics
8600 FOUNDRY ST., SUITE 306
MILL BOX 2054
SAVAGE, MD 20763
(410) 696-4512
building-dynamics.com

ELECTRICAL ENGINEERS

PAULCO ENGINEERING, INC.
14211 MEADOW LAKE DRIVE
GLENELG, MD 21737
p: 301.523.5012

PROJECT

BONNIE BRANCH MIDDLE SCHOOL
CONTROLS UPGRADE
4979 ILCHESTER ROAD
ELLICOTT CITY, MD 21043

KEY PLAN

NO.	DESCRIPTION	DATE
	100% CONSTRUCTION DOCUMENTS	03/31/2023

DRAWING

ELECTRICAL SCHEDULES

DRAWN BY	PG
CHECKED BY	PG
PROJECT NO.	202302
SCALE	NONE
SHEET	E3.1