UNION COUNTY BOARD OF EDUCATION
CONTRACT ROUTING SHEET

Contractor Name: E2 Mechanical LLC
UCPS Contract Number: 4-97380026
Address: 4933 Brookshire Boulevard
City, State, Zip: Charlotte, NC 28216
Contact Name: Dan Ranson
Telephone Number: 980.365.7615

Purpose of Contract (location and brief description): Wesley Chapel Elementary School Rooftop Unit Replacement (HVAC)

Submitting Department: Facilities Department
Date Submitted: 03.29.2024

Budget Account Number: _____
Funding Source: CIP
Contract Amount: $ 852,254.00
Contract Period: 180 consecutive calendar days

UCPS Employee to Contact: Penny Helms/Danny McManus
Phone Number: 704-296-3160

NOTE: Individuals listed below should initial, date, and forward this form after completing their responsibilities relating to this Contract.

	Date Received	Date Processed	Initials
1. Approved by Fund Owner/Acquire Vendor Signature and proper **Insurance Certificate with UCBOE NAMED as CERTIFICATE HOLDER.**			
A. Insurance Certificate Reviewed/Approved by Risk Management		4/8/2024 | 10:47 AM EDT	DS SH
2. Approved by Appropriate Representative(s) of UCPS:			
☑ UCPS Project Coordinator		4/1/2024 | 8:45 PM EDT	DS
☑ UCPS Department Head/School Principal		4/2/2024 | 10:12 AM EDT	DS
☑ Asst. Supt. for Administration & Operations		4/2/2024 | 11:13 AM EDT	DS
☐ Asst. Supt. for Human Resources	N/A	N/A	N/A
☐ Asst. Supt. for Instructional Programs	N/A	N/A	N/A
☐ Asst. Supt. for Communications	N/A	N/A	N/A
☐ Chief School Performance Officer	N/A	N/A	N/A
☐ Chief Technology Officer	N/A	N/A	N/A
FORWARD TO UCPS GENERAL COUNSEL OFFICE			
3. Approved by Legal Counsel	DS SS	DS KB	DS MM
FORWARD TO SUPERINTENDENT/BOARD OF EDUCATION			
4. Approved by Superintendent		4/8/2024 | 2:48 PM EDT	DS
5. Approved by Board of Education			
FORWARD TO FINANCE			
6. Pre-audited by Representative of Finance Officer		4/8/2024 | 8:15 AM PDT	DS SM
FORWARD TO PURCHASING			
7. Purchase Order Number assigned by Purchasing Director, or designee, and contract distributed			

Contract #:4-97380026

CONTRACT
WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT (HVAC)

This **Contract** ("Contract") is made and entered into 12th day of March 2024 between **The Union County Board of Education**, with a mailing address of 400 North Church Street, Monroe, North Carolina 28112 ("UCBOE") and E2 Mechanical LLC, located at 4933 Brookshire Boulevard, Charlotte, North Carolina 28216 ("Vendor" or "Contractor" or "Service Provider").

For and in consideration of the mutual promises set forth in this Contract, the parties do mutually agree as follows:

1. Obligations of Vendor. The Vendor agrees to provide the services, goods, materials, equipment, and/or software (the "Services" and/or "Goods," as appropriate) to fully, timely and properly complete the Wesley Chapel Elementary School Rooftop Unit Replacement (HVAC) project. as more particularly described in the Scope of Work document attached hereto and incorporated herein by reference as Exhibit 1.
   The UCBOE and Vendor recognize that time is of the essence to this Agreement and that the UCBOE will suffer financial loss if the work is not completed within the times specified herein. Both parties also recognize the delays, difficulties and expense involved in proving, in a legal or arbitration proceeding, the actual loss suffered by the UCBOE if the Work is not completed on time. Accordingly, in lieu of requiring such proof, the UCBOE and Vendor agree that as liquidated damages for delay (but not as penalty) the Vendor shall pay to the UCBOE for each day in excess of the term allowed for Substantial Completion of the Work, the sum of $500 as liquidated damages. The amount of $250 per calendar day for failing to meet the Final Completion Date until Final Completion is actually achieved.
   The term of this Contract shall be per Exhibit 1.
   This Contract does not grant the Vendor the right or the exclusive right to provide specified Services and/or Goods to UCBOE. Similar Services and/or Goods may be obtained from sources other than the Vendor (or not at all) at the discretion of UCBOE.
   The Vendor shall begin work immediately upon issuance of a written notice to proceed and be complete within the time identified within Exhibit 1. The Vendor agrees to perform the Services and supply the Goods in a timely, complete, and professional manner and in accordance with the terms and conditions of this Contract. Furthermore, the Vendor represents and warrants that (i) it is duly qualified and, if required by law, licensed to provide the Services and/or Goods; (ii) it will provide the Services and/or Goods in a manner consistent with the level of care and skill ordinarily exercised by contractors providing similar Services and/or Goods under similar conditions; (iii) it possesses sufficient experience, personnel, and resources to provide the Services and/or Goods; (iv) it shall provide the Services and/or Goods in compliance with applicable laws, statutes, ordinances, codes, orders, rules and regulations; and (v) its reports, if any, shall be complete, accurate, and unambiguous.

2. Obligations of UCBOE. UCBOE hereby agrees to pay to the Vendor for the faithful performance of this Contract, and the Vendor hereby agrees to provide all of the Services and/or Goods, for the sum not to exceed $852,254.00 ("Contract Price") subject to adjustments as provided for in the Contract Documents.

Base Bid (Rooftop Units)	$ 708,186.00
Alternate 1 (Air Handling Unit)	$ 111,679.00
Alternate 2 (VAV Boxes)	$ 12,389.00
Allowance Funds	$ 20,000.00
Total	$ 852,254.00 (Eight Hundred Fifty-Two Thousand, Two Hundred Fifty-Four Thousand Dollars)

3. Project Coordinator. **Karl Todd** is designated as the Project Coordinator for UCBOE. The Project Coordinator shall be UCBOE's representative in connection with the Vendor's performance under this Contract. UCBOE has complete discretion in replacing the Project Coordinator with another person of its choosing.

4. Vendor Supervisor. **Dan Ranson** is designated as the Vendor Supervisor for the Vendor. The Vendor Supervisor is fully authorized to act on behalf of the Vendor in connection with this Contract.

5. Terms and Methods of Payment. UCBOE will make payment after invoices are approved on a net 30-day basis. UCBOE will not pay for services or materials in advance without the prior approval of the Finance Officer. 5% Retainage will be held as allowed by NCGS.

6. Standard Terms and Conditions: Vendor agrees to the Standard Terms and Conditions set forth as Attachment A attached hereto and incorporated herein by reference.

7. Counterpart Execution. This Contract may be executed and recorded in two or more counterparts, each of which shall be deemed an original and all of which, when taken together, shall constitute one and the same instrument. Each party shall be entitled to rely upon executed copies of this Contract transmitted by facsimile or electronic "PDF" to the same and full extent as the originals.

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[SIGNATURES ON NEXT PAGE]

IN WITNESS WHEREOF, UCBOE and the Vendor have executed this Contract on the day and year first written above.

E2 Mechanical, LLC

Vendor Name

DocuSigned by:
Joshua Chertoff 4/4/2024 | 1:23 PM PDT

Signature of Authorized Representative Date

30-0021918

Vendor's Federal Identification #
[if Contract is with Organization or Social Security Number if individual]

THE UNION COUNTY BOARD OF EDUCATION

DocuSigned by:
Kathy Heintel 4/8/2024 | 2:48 PM EDT

Authorized Representative Date

This instrument has been preaudited in the manner required by the School Budget and Fiscal Control Act.

DocuSigned by:
Shanna McLamb 4/8/2024 | 8:15 AM PDT

Finance Officer Date

DocuSigned by:
Sara Hymel 4/8/2024 | 10:47 AM EDT

Risk Management Date

As to form:

DocuSigned by:
Michele Morris 4/7/2024 | 5:21 AM PDT

UCBOE Attorney Date

Attachment A

Standard Terms and Conditions

I. Standard Terms and Conditions for All Contracts

1. Defined Terms, "Contract" means the agreement between UCBOE and Vendor which consists of the applicable Contract Documents. "Contract Documents" means: (i) any applicable purchase order between Vendor and UCBOE specifically including all terms and conditions set forth or referenced herein and on the face of a Purchase Order, (ii) any attachments hereto, (iii) any applicable solicitation documentation related to hereto (including without limitation any request for proposals or invitation for bids and Vendor's response thereto), and (iv) any other terms and conditions of a written agreement signed by Vendor and UCBOE that deals with the same subject matter. "Goods" means any supplies, materials, products or other tangible personal property provided by Vendor to UCBOE. "Purchase Order" mean any applicable purchase order issued by UCBOE. "Services" means services, specifically including without limitation construction services, design services, professional or consulting services and software as a service, "UCBOE" means the Union County Board of Education. "Vendor" means the party contracting with UCBOE and includes individual and entities that may be referred to in Contract Documents as "vendor", "seller", "service provider", or "contractor".
2. Written Agreement Signed by Both Parties; Acceptance of Purchase Order Terms and Conditions when there is not a Separate Written Agreement Signed by Both Parties. When a Contract is signed by both UCBOE and Vendor then the Purchase Order issued by UCBOE is for administrative convenience and is not part of the Contract Documents. When there is not a separate Contract signed by both UCBOE and Vendor, then Vendor's acknowledgment of the terms of any Purchase Order, without timely objection, or Vendor's shipment or performance of any part of a Purchase Order, constitutes an agreement to all terms and conditions set forth or referenced herein and on the face of the Purchase Order, together with the terms and conditions of any other applicable Contract Documents. The terms and provisions set forth in the Contract Documents shall constitute the entire agreement between Vendor and UCBOE with respect to the purchase by UCBOE of the Services and/or Goods work performed as described in the Contract Documents. In the event of any conflict between any terms and conditions of the Contract Documents, the terms and conditions most favorable to UCBOE shall control. A Purchase Order constitutes an offer by UCBOE and expressly limits acceptance to the terms and conditions stated therein. No additional or supplemental provision or provisions in variance herewith that may appear in Vendor's quotation, acknowledgment, invoice, or in any other communication from Vendor to UCBOE shall be deemed accepted by or binding on UCBOE. UCBOE hereby expressly rejects all such provisions which supplement, modify or otherwise vary from the terms of the Contract Documents, and such provisions are superseded by the terms and conditions stated in the Contract Documents, unless and until UCBOE's authorized representatives expressly assent, in writing, to such provisions. Stenographic and clerical errors and omissions by UCBOE are subject to correction.
3. Cancellation of Purchase Order. UCPS may cancel any Purchase Order or portion thereof without liability, if: (a) Vendor fails upon request to give reasonable assurance of timely performance or UCPS otherwise determines that it has reasonable grounds for insecurity regarding Vendor's performance; (b) conforming Goods or Services (including the quantities specified for delivery) are not delivered within the time specified or, if no time is specified, within a commercially reasonable time; (c) Vendor otherwise breaches the Contract and such breach is not corrected within thirty (30) days following written notice of breach; or (d) cancellation is otherwise required or allowed by law.
4. Quantities. Shipments must equal exact amounts ordered unless otherwise agreed in writing by UCBOE. The award of a term contract neither implies nor guarantees any minimum or maximum purchases. Materials received in excess of quantity specified on the purchase order , at UCBOE option's, may be returned at the Vendor's expense.
5. Prices. If Vendor's price or the regular market price of any of the Goods covered hereunder is lower than the price stated in the Contract Documents on the date of shipment of such Goods, Vendor agrees to give UCBOE the benefit of such lower price on any such Goods. In no event shall Vendor's price be higher than the price last quoted or last charged to UCBOE unless otherwise agreed in writing. No charges for transportation, boxing, crating, etc. are allowable unless such charges are included in the Contract Documents.
6. Invoices. It is understood and agreed that orders will be shipped at the established Contract prices in effect on dates orders are placed. Invoicing at variance with this provision may subject the Contract to cancellation.

Applicable North Carolina sales tax shall be invoiced as a separate item. Invoices shall be sent to UCBOE's accounts payable department with a copy to UCBOE Project Coordinator.

7. Freight on Board. All shipments of Goods are FOB destination unless otherwise stated in the Contract Documents. Any freight charges prepaid by Vendor are to be itemized on the invoice unless stated otherwise in writing by form of quote, bid, contract. In instances where Goods are shipped against this order by parties other than those specified on the Purchase Order, the third=party shipper must be instructed to list the UCBOE purchase order number on all packages, bills of lading, etc. to insure prompt identification of order.
8. Taxes. Taxes are included in the Contract Price. Applicable taxes shall be invoiced as a separate item for UCBOE's records.
9. Payment Terms. Payment terms are Net 30 days after receipt of correct invoice or acceptance of Goods, whichever is later.
10. Condition and Packaging. Unless otherwise provided by special terms and conditions or specifications, it is understood and agreed that any item offered or shipped has not been sold or used for any purpose and shall be in first class condition. All containers/packaging shall be suitable for handling, storage or shipment.
11. Safety Data Sheets. Safety Data Sheets must be provided with shipment of all chemicals."
12. Delays in Shipment. Time and date of delivery are of the essence, except when delay is due to causes beyond Vendor's reasonable control and without Vendor's fault or negligence.
13. Risk of Loss. Vendor shall have the risk of loss of and damage to the Goods subject to the Contract Documents until such Goods are delivered to the destination and accepted by UCBOE or its nominee.
14. Rejection. All Goods shall be received subject to UCBOE's inspection. Goods that are defective in workmanship or material or otherwise not in conformity with the requirements of the Contract Documents may be rejected and returned at Vendor's expense or may be accepted at a reduced price. UCBOE may require Vendor to promptly replace or correct any rejected Goods Services and, if Vendor fails to do so, UCBOE may contract with a third party to replace such Goods Services and charge Vendor the additional cost.
15. Warranties. Vendor warrants that all Goods delivered hereunder will be free from defects in materials and workmanship and will conform strictly to the specifications, drawings, or samples specified or furnished. This warranty shall survive any inspection, delivery, acceptance or payment by UCBOE of the Goods and shall run to UCBOE and any user of the Goods. This express warranty is in addition to Vendor's implied warranties of merchantability and fitness for a particular purpose which shall not be disclaimed. In addition to any other rights available at law or equity, UCBOE shall be entitled to all rights and remedies provided by the Uniform Commercial Code, Chapter 25 of the North Carolina General Statutes, for breach of express warranties and implied warranties of merchantability or fitness for a particular purpose, including but not limited to consequential and incidental damages.
16. Compliance with All Laws. Vendor warrants that all performance hereunder shall be in accordance with all applicable federal, state and local laws, regulations and orders. The right of Vendor to proceed may be terminated immediately by written notice if UCBOE determines that Vendor, its agent or another representative, has violated any provision of law.
17. Use of Federal Funds. If the source of funds for this Contract is federal funds, the following federal provisions apply pursuant to 2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II (as applicable):Equal Employment Opportunity (41 C.F.R. Part 60); Davis-Bacon Act (40 U.S.C. 3141-3148); Copeland "Anti-Kickback" Act (40 U.S.C. 3145); Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708); Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387); Debarment and Suspension (Executive Orders 12549 and 12689); Byrd Anti-Lobbying Amendment (31 U.S.C. 1352); Procurement of Recovered Materials (2 C.F.R. § 200.322); and Record Retention Requirements (2 CFR § 200.324).
18. Registered Sex Offenders; Jessica Lunsford Act. Under North Carolina law, certain sex offenders are prohibited from coming onto school campuses. Vendor agrees to conduct an annual check of the N.C. Sex Offender and Public Protection Registration Program, the N.C. Sexually Violent Predator Registration Program and the National Sex Offender Registry for all of its employees whose job involves direct interaction with students as part of the job. UCBOE prohibits any personnel listed on such registries from being on any property owned or operated by UCBOE and from having any direct interaction with students. As a term of the Agreement, said checks must be performed by the Vendor and reported to UCBOE's Superintendent or designee, if Vendor's employees will be working directly with students. Under provisions set forth in the Jessica Lunsford Act under North Carolina law, the signature below certifies that neither Vendor nor any employee or agent of Vendor is

listed as a sex offender on the N.C. Sex Offender and Public Protection Registration Program, the N.C. Sexually Violent Predator Registration Program, and/or the National Sex Offender Registry.

19. Nondiscrimination. During the performance of the Contract, Vendor shall not discriminate against or deny the Contract's benefits to any person on the basis of sexual orientation, national origin, race, ethnic background, color, religion, gender, age or disability.
20. FERPA Electronically Stored Data Compliance: Vendor is expressly prohibited from selling or trading any education records or personally identifiable information acquired under the Agreement. Furthermore, Vendor agrees not to attempt to re-identify students from aggregated data. Further, Vendor will not use any personally identifiable information or education records to advertise or market to students of UCBOE or their parents. Any personally identifiable information and education records held by Vendor pursuant to the Agreement will be made available to UCBOE upon request. Vendor will store and process all data using appropriate administrative, physical, and technical safeguards to secure personally identifiable information and education records from unauthorized access, disclosure, and use. Vendor will conduct periodic risk assessments and remediate any identified security vulnerabilities in a timely manner. Vendor will also have a written incident response plan, to include prompt notification to UCBOE in the event of a security or privacy incident, as well as procedures for responding to a breach of data. Vendor agrees to share its incident response plan upon request. Vendor shall, for all personally identifiable data and education records in its possession and in the possession of any subcontractors, or agents to which it has transferred data as permitted herein, destroy or de-identify such data when such data is no longer needed to perform the Agreement. Vendor hereby agrees to abide by all Board of Education policies and procedures governing the confidentiality of student records and the responsible use of technology and internet safety. If Vendor experiences a security breach concerning any information covered by the Agreement, and such breach is covered by N.C.G.S. §75.61(14), then Vendor will (a) fully comply with Vendor's obligations under the N.C. Identity Theft Protection Act, (b) immediately notify UCBOE with the information listed in N.C.G.S. §75-65(d)(1-4), and (c) fully cooperate with UCBOE in carrying out its obligations under said Identity Theft Protection Act. Vendor will indemnify UCBOE for any breach of confidentiality or failure of its responsibilities to protect confidential information, and for cost of notification of affected persons as a result of its accidental or negligent release of personally identifiable information or education records provided to Vendor pursuant to the Agreement.
21. North Carolina Public Records Law: Vendor acknowledges that UCBOE is subject to the requirements of North Carolina's Public Records Law ("NCPRL"), N.C.G.S. § 132-1, et. seq. The Agreement and any related documents, papers, letters, maps, books, photographs, films, sound recordings, magnetic or other tapes, electronic data-processing records, artifacts, or other documentary material, regardless of physical form or characteristics, made or received by UCBOE in connection with the transaction of the Agreement may be considered a "public record," subject to disclosure under the NCPRL. UCBOE is under no obligation to notify Vendor prior to its compliance of its duties under NCPRL.
22. Conflict of Interest. Vendor represents and warrants that no member of UCBOE or any of its employees or officers who may obtain a direct benefit, personal gain or advantage for themselves or a relative or associate as a result of the Contract, subcontract or other agreement related to the Contract is in a position to influence or has attempted to influence the making of the Contract, has been involved in making the Contract, or will be involved in administering the Contract. Vendor also represents and warrants that, if the Contract is funded by any amount of federal funds, no violation of 2 C.F.R. § 200.318(c) or any other applicable federal conflict of interest law has occurred or will occur. Vendor shall cause this paragraph to be included in all Contracts, subcontracts and other agreements related to the Contract.
23. Gratuities. Vendor represents and warrants that no member of UCBOE or any of its employees has been or will be offered or given a gratuity to an official or employee of UCBOE in violation of applicable law or policy.
24. Kickbacks to Vendor. Vendor shall not permit any kickbacks or gratuities to be provided, directly or indirectly, to itself, its employees, subcontractors or subcontractor employees for the purpose of improperly obtaining or rewarding favorable treatment in connection with a UCBOE Contract or in connection with a subcontract relating to a UCBOE Contract. When Vendor has grounds to believe that a violation of this clause may have occurred, Vendor shall promptly report to UCBOE in writing the possible violation.
25. Iran Divestment Act. Vendor certifies that, as of the date listed below, it is not on the Final Divestment List, as created by the State Treasurer pursuant to N.C.G.S. § 143-6A-4, in violation of the Iran Divestment Act. In compliance with the requirements of the Iran Divestment Act and N.C.G.S. § 143C-6A-5(b), Vendor shall not

utilize in the performance of the contract any subcontractor that is identified on the Final Divestment List. The Final Divestment List can be found on the State Treasurer's website at the address www.nctreasurer.com/Iran and should be updated every 180 days.

26. Divestment from Companies that Boycott Israel. The Vendor certifies that it has not been designated by the North Carolina State Treasurer as a company engaged in the boycott of Israel pursuant to N.C.G.S. 147-86.81. It is the responsibility of each vendor or contractor to monitor compliance with this restriction. Contracts valued at less than $1,000.00 are exempt from this restriction.
27. E-Verification. Vendor shall comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes
28. Indemnification. To the fullest extent permitted by law, Vendor shall indemnify and hold harmless UCBOE, its officers, agents, employees and assigns from and against all claims, losses, costs, damages, expenses, attorneys' fees and liability that any of them may sustain (a) arising out of Vendor's failure to comply with any applicable law, ordinance, regulation, or industry standard or (b) arising directly or indirectly out of Vendor's performance or lack of performance of the terms and conditions of the Contract. In the event that any Services and/or Goods sold and delivered or sold and performed under the Contract Documents shall be defective in any respect whatsoever, Vendor shall indemnify and save harmless UCBOE, its officers, agents, employees and assigns from all loss or the payment of all sums of money by reason of all accidents, injuries or damages to persons or property that shall happen or occur in connection with the use or sale of such Services and/or Goods and are contributed to by said condition. In the event Vendor, its employees, agents, subcontractors and or lower-tier subcontractors enter premises occupied by or under the control of UCBOE in the performance of the Contract Documents, Vendor agrees that it will indemnify and hold harmless UCBOE, its officers, agents, employees and assigns, from any loss, costs, damage, expense or liability by reason of property damage or personal injury of whatsoever nature or kind arising out of, as a result of, or in connection with such entry.
29. Insurance. Unless such insurance requirements are waived or modified by UCBOE or risk management ("DIRM"), Vendor certifies that it currently has and agrees to purchase and maintain during its performance under the Contract the following insurance from one or more insurance companies acceptable to UCBOE and authorized to do business in the State of North Carolina: Automobile - Vendor shall maintain bodily injury and property damage liability insurance covering all owned, non-owned and hired automobiles. The policy limits of such insurance shall not be less than $1,000,000 combined single limit each person/each occurrence. Commercial General Liability - Vendor shall maintain commercial general liability insurance that shall protect Vendor from claims of bodily injury or property damage which arise from performance under the Contract. This insurance shall include coverage for contractual liability. The policy limits of such insurance shall not be less than $1,000,000 combined single limit each occurrence/annual aggregate. Worker's Compensation and Employers' Liability Insurance - If applicable to Vendor, Vendor shall meet the statutory requirements of the State of North Carolina for worker's compensation coverage and employers' liability insurance. Vendor shall also provide any other insurance or bonding specifically recommended in writing by the DIRM or required by applicable law. Certificates of such insurance shall be furnished by Vendor to UCBOE and shall contain the provision that UCBOE be given 30 days' written notice of any intent to amend or terminate by either Vendor or the insuring company. Failure to furnish insurance certificates or to maintain such insurance shall be a default under the Contract and shall be grounds for immediate termination of the Contract.
30. Termination for Convenience. In addition to all of the other rights which UCBOE may have to cancel this Contract or an applicable Purchase Order, UCBOE shall have the further right, without assigning any reason therefore, to terminate the Contract (or applicable Purchase Order), in whole or in part, at any time at its complete discretion by providing 10 days' notice in writing from UCBOE to Vendor. If the Contract is terminated by UCBOE in accordance with this paragraph, Vendor will be paid in an amount which bears the same ratio to the total compensation as does the Services and/or Goods actually delivered or performed to the total originally contemplated in the Contract. UCBOE will not be liable to Vendor for any costs for completed Goods, Goods in process or materials acquired or contracted for if such costs were incurred prior to the date of this Contract or an applicable Purchase Order.
31. Termination for Default. UCBOE may terminate the Contract, in whole or in part, immediately and without prior notice upon breach of the Contract by Vendor. In addition to any other remedies available to UCBOE law or equity, UCBOE may procure upon such terms as UCBOE shall deem appropriate, Services and/or Goods

substantially similar to those so terminated, in which case Vendor shall be liable to UCBOE for any excess costs for such similar goods, supplies, or services and any expenses incurred in connection therewith.

32. Contract Funding. It is understood and agreed between Vendor and UCBOE that UCBOE's obligation under the Contract is contingent upon the availability of appropriated funds from which payment for Contract purposes can be made. No legal liability on the part of UCBOE for any payment may arise until funds are made available to UCBOE's Finance Officer and until Vendor receives notice of such availability. Should such funds not be appropriated or allocated, the Contract shall immediately be terminated. UCBOE shall not be liable to Vendor for damages of any kind (general, special, consequential or exemplary) as a result of such termination.
33. Accounting Procedures. Vendor shall comply with any accounting and fiscal management procedures prescribed by UCBOE to apply to the Contract and shall assure such fiscal control and accounting procedures as may be necessary for proper disbursement of and accounting for all project funds.
34. Improper Payments. Vendor shall assume all risks attendant to any improper expenditure of funds under the Contract. Vendor shall refund to UCBOE any payment made pursuant to the Contract if it is subsequently determined by audit that such payment was improper under any applicable law, regulation or procedure. Vendor shall make such refunds within thirty (30) days after UCBOE notifies Vendor in writing that a payment has been determined to be improper.
35. Contract Transfer. Vendor shall not assign, subcontract or otherwise transfer any interest in the Contract without the prior written approval of UCBOE.
36. Contract Personnel. Vendor agrees that it has, or will secure at its own expense, all personnel required to provide the Services and/or Goods set forth in the Contract.
37. Key Personnel. Vendor shall not substitute for key personnel (defined as those individuals identified by name or title in the Contract Documents or in written communication from Vendor) assigned to the performance of the Contract without prior written approval from UCBOE Project Coordinator (the individual at UCBOE responsible for administering the Contract).
38. Contract Modifications. The Contract may be amended only by written amendment duly executed by both UCBOE and Vendor.
39. Relationship of Parties. Vendor is an independent contractor and not an employee of UCBOE. The conduct and control of the work will lie solely with Vendor. The Contract shall not be construed as establishing a joint venture, partnership or any principal-agent relationship for any purpose between Vendor and UCBOE. Employees of Vendor shall remain subject to the exclusive control and supervision of Vendor, which is solely responsible for their compensation.
40. Advertisement. The Contract will not be used in connection with any advertising by Vendor without prior written approval by UCBOE.
41. Monitoring and Evaluation. Vendor shall cooperate with UCBOE, or with any other person or agency as directed by UCBOE, in monitoring, inspecting, auditing or investigating activities related to the Contract. Vendor shall permit UCBOE to evaluate all activities conducted under the Contract. UCBOE has the right at its sole discretion to require that Vendor remove any employee of Vendor from UCBOE Property and from providing Services and/or Goods under the Contract following provision of notice to Vendor of the reasons for UCBOE's dissatisfaction with the Services and/or Goods of Vendor's employee.
42. Financial Responsibility. Vendor is financially solvent and able to perform under the Contract. If requested by UCBOE, Vendor agrees to provide a copy of its latest audited annual financial statements or other financial statements as deemed acceptable by UCBOE's Finance Officer. In the event of any proceedings, voluntary or involuntary, in bankruptcy or insolvency by or against Vendor, the inability of Vendor to meet its debts as they become due or in the event of the appointment, with or without Vendor's consent, of an assignee for the benefit of creditors or of a receiver, then UCBOE shall be entitled, at its sole option, to cancel any unfilled part of the Contract without any liability whatsoever.
43. Governmental Restrictions. In the event any governmental restrictions are imposed which necessitate alteration of the material, quality, workmanship or performance of the items offered prior to their delivery, it shall be the responsibility of the Vendor to notify, in writing, the issuing purchasing office at once, indicating the specific regulation which required such alterations. UCBOE reserves the right to accept any such alterations, including any price adjustments occasioned thereby, or to cancel the Contract.
44. Inspection at Vendor's Site. UCBOE reserves the right to inspect, at a reasonable time, the equipment/item, plant or other facilities of a prospective contractor prior to Contract award, and during the Contract term as

necessary for UCBOE determination that such equipment/item, plant or other facilities conform with the specifications/requirements and are adequate and suitable for the proper and effective performance of the Contract.

45. Confidential Information. All information about UCBOE provided to the Vendor or its officers, employees, agents, representatives and advisors (the "Vendor Representatives"), and all copies or other full or partial reproductions thereof and notes, memoranda or other writings related thereto created by Vendor or any Vendor Representative, regardless of whether provided before or after the date of the Contract and regardless of the manner or medium in which it is furnished, is referred to as "Confidential Information". Confidential Information does not include any information that (a) is or becomes generally available to the public other than as a result of an impermissible disclosure by Vendor, (b) was known by or available on a nonconfidential basis to Vendor before it was disclosed by UCBOE or (c) becomes available to Vendor on a nonconfidential basis from a third party whom Vendor does not know to be bound by a confidentiality agreement with, or have an obligation of secrecy to, UCBOE. Except as and to the extent required by law or order or demand of any governmental or regulatory authority, Vendor and Vendor Representatives will (x) keep all Confidential Information confidential and (y) will only disclose or reveal any Confidential Information to Vendor Representatives who must have the information to fulfill Vendor's obligations under the Contract and who agree to observe the terms of this Section. Vendor and Vendor Representatives will not use the Confidential Information for any purpose other than fulfilling Vendor's obligations under the Contract. By way of example and not limitation, Vendor shall not sell, market, or commercialize Confidential Information, create derivative products or applications based on Confidential Information. If Vendor is requested or required, pursuant to applicable law or regulation or by legal process, to disclose any Confidential Information, Vendor will provide UCBOE with prompt and timely notice of the requests or requirements so that UCBOE can seek an appropriate protective order or other remedy and will not be prejudiced by delay. If UCBOE does not obtain a protective order or other remedy, Vendor will only disclose that portion of the Confidential Information which Vendor's legal counsel determines Vendor is required to disclose. Upon termination of the Contract or otherwise upon UCBOE's request, Vendor will promptly deliver to UCBOE all Confidential Information in the possession of Vendor or the Vendor Representatives.
Student Information: If, during the course of Vendor's performance of the Contract, Vendor should obtain any information pertaining to students or students' official records, Vendor agrees to keep any such information confidential and to not disclose or permit it to be disclosed, directly or indirectly, to any person or entity. The Contract shall not be construed by either party to constitute a waiver of or to in any manner diminish the provisions for confidentiality of students' records. Additionally, pursuant to N.C.G.S. 115C-401.1, it is unlawful for a person who enters into a contract with a local board of education to sell personally identifiable information that is obtained from a student as a result of that person's performance under the Contract. Employee Personnel Information: If, during the course of Vendor's performance of the Contract, Vendor should obtain any information pertaining to employees of UCBOE's personnel records, Vendor agrees to keep any such information confidential and to not disclose or permit it to be disclosed, directly or indirectly, to any person or entity. This section will survive the termination of this Contract.
46. Intellectual Property. Vendor agrees, at its own expense, to indemnify, defend and save UCBOE harmless from all liability, loss or expense, including costs of settlement and attorney's fees, resulting from any claim that UCBOE's use, possession or sale of the Services and/or Goods infringes any copyright, patent or trademark or is a misappropriation of any trade secret.
47. No Pre-Judgment or Post-Judgment Interest. In the event of any action by Vendor for breach of contract in connection with the Contract, any amount awarded shall not bear interest either before or after any judgment, and Vendor specifically waives any claim for interest.
48. Background Checks. At the request of UCBOE's Project Coordinator, Vendor (if an individual) or any individual employees of Vendor shall submit to UCBOE criminal background check and drug testing procedures.
49. Mediation. If a dispute arises out of or relates to the Contract, or the breach of the Contract, and if the dispute cannot be settled through negotiation, the parties agree to try in good faith to settle the dispute by mediation administered by the American Arbitration Association under its Commercial Mediation Rules before resorting to litigation.

50. No Third-Party Benefits. The Contract shall not be considered by Vendor to create any benefits on behalf of any third party. Vendor shall include in all contracts, subcontracts or other agreements relating to the Contract an acknowledgment by the contracting parties that the Contract creates no third-party benefits.
51. Force Majeure. Neither party shall be responsible to the other for any losses resulting from the failure to perform any terms or provisions of the Agreement if the party's failure to perform is attributable to war, riot or other disorder, strike or other work stoppage; fire; flood; storm; illness; pandemic, communicable disease, or any other act not within the control of the party whose performance is interfered with, and which, by reasonable diligence, such party is unable to prevent. However, UCBOE will be entitled to a refund for fees paid on account of services not rendered by Vendor including any and all deposits.
52. Ownership of Documents; Work Product. All documents created pursuant to the Contract shall, unless expressly provided otherwise in writing, be owned by UCBOE. Upon the termination or expiration of the Contract, any and all finished or unfinished documents and other materials produced by Vendor pursuant to the Contract shall, at the request of UCBOE, be turned over to UCBOE. Any technical knowledge or information of Vendor which Vendor shall have disclosed or may hereafter disclose to UCBOE shall not, unless otherwise specifically agreed upon in writing by UCBOE, be deemed to be confidential or proprietary information and shall be acquired by UCBOE free from any restrictions as part of the consideration of the Contract.
53. Strict Compliance. UCBOE may at any time insist upon strict compliance with these terms and conditions notwithstanding any previous course of dealing or course of performance between the parties to the contrary.
54. General Provisions. UCBOE's remedies as set forth herein are not exclusive. Any delay or omission in exercising any right hereunder, or any waiver of any single breach or default hereunder, shall not be deemed to be a waiver of such right or of any other right, breach, or default. If action be instituted by Vendor hereunder, UCBOE shall be entitled to recover costs and reasonable attorney's fees. Vendor may not assign, pledge, or in any manner encumber Vendor's rights under this Contract or applicable Purchase Order or delegate the performance of any of its obligations hereunder, without UCBOE's prior, express written consent.
55. Contract Situs. All matters, whether sounding in contract or tort relating to the validity, construction, interpretation and enforcement of the Contract, will be determined in Union County, North Carolina. North Carolina law will govern the interpretation and construction of the Contract.
56. Severability. Any provision of this Contract that is determined by any court of competent jurisdiction to be invalid or unenforceable will not affect the validity or enforceability of any other provision. Any provision of the Contract held invalid or unenforceable only in part or degree will remain in full force and effect to the extent not held invalid or unenforceable.

II. Additional Standard Terms and Conditions for Construction Contracts

1. Supervision and Provision for Labor and Supplies. The Vendor will supervise and direct the construction work (the "Work") and shall furnish, provide, and pay for all labor, materials, equipment, machinery, utilities, and services reasonably necessary for the execution and completion of the Work.
2. Coordination of Work and Notification of Progress. The Vendor agrees to coordinate its Work with the work of any other separate contractors or with the work of UCBOE's own forces to avoid delaying or interfering with their work. Vendor shall enforce good order and discipline among his employees and subcontractors on the Project. The Vendor further agrees to inform UCBOE on a regular basis or at UCBOE's request of the progress of the Work.
3. Provision for all Permits, Licenses, and Inspections. Unless otherwise provided, the Vendor shall secure and pay for all permits, licenses, and inspections necessary for the proper execution and completion of the Work.
4. Cleanliness. Vendor shall keep the Project reasonably free from waste materials or rubbish resulting from the Vendor's operations.
5. Additional Warranties. The Vendor warrants that the Vendor has visited the location of the Project and is familiar with all field conditions bearing upon the Vendor's performance of the Work; that the materials and equipment furnished under the Contract are of good quality and new (unless otherwise permitted); that the Work is non-negligent and meets or exceeds the standards ordinarily observed in the industry; and that the Work conforms to the requirements of the Contract and to all applicable codes, ordinances, laws, or regulations. The Vendor further warrants and promises that the Work shall be free from defects

and nonconformities in materials and workmanship for a period of one year from the later of the Date of Completion, which is the date UCBOE accepts the Work or such date as the Vendor actually completes all the Work (the "Date of Completion"). During such period, the Vendor will remedy at Vendor's expense nonconformities or defects in the Work within a reasonable time after receiving notice thereof from UCBOE.

6. Indemnity for Subcontractor Payment. In addition to the indemnification obligations contained in the attached terms and conditions to this Contract, the Vendor further agrees to defend and indemnify UCBOE from and against all claims, damages, losses, and expenses, including reasonable attorneys' fees, arising out of the Vendor's failure to pay subcontractors or materials suppliers.
7. Change Orders. The Vendor agrees that UCBOE may order changes in the general scope of the Work, including additions, deletions, and similar revisions. The parties agree to adjust the Contract Price and Date of Completion to reflect the effects of such changes, which adjustments shall be authorized only upon execution of a written change order (a "Change Order"). In case of emergency or extenuating circumstances or if a construction contingency is provided as stated below, approval of changes may be obtained verbally by telephone or field orders approved by UCBOE Project Coordinator and promptly thereafter substantiated in writing as outlined under normal procedures. The amount of any increase or decrease in the Contract Price shall be by mutual acceptance of a total amount supported by sufficient data and information to substantiate the change. Any decrease in Contract Price for a decrease in the Work will be the reasonable costs of the Work deleted, including a reasonable amount for the decrease in the Vendor's overhead.
8. Performance/Payment Bond. If required by law and/or the bidding documentation, the Vendor agrees to provide a Performance Bond and Labor and Material Payment Bond for its faithful performance in a form reasonably satisfying to UCBOE.
9. Payments Withheld. The UCBOE may withhold payment for the following reasons to the extent permitted under N.C. Gen. Stat. § 143-134.1(e): (1) defective Work not remedied; (2) third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to UCBOE is provided by the Vendor; (3) failure of the Vendor to make payments properly to subcontractors or for labor, materials or equipment; (4) reasonable evidence that the Work will not be completed with the time specified, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; (5) failure to carry out the Work in accordance with the Contract Documents; (6) failure to provide sales tax documentation in accordance with subparagraph 9.3.5; (7) failure or refusal of the Vendor to submit the required information on minority business enterprises; and (8) failure of the Vendor to comply with (a) the provisions of the Sedimentation and Pollution Control Act (N.C. Gen. Stat. § 113A-50 *et seq*.), and/or (b) any Notice of Violation issued by the North Carolina Department of Natural Resources.
10. Retainage. For public construction contracts costing an amount equal to or greater than $100,000, the UCBOE will retain five percent of the amount of each progress payment on the project for as long as is authorized by N.C. Gen. Stat. § 143-134.1. At all times during the Project, the UCBOE may retain the maximum funds allowed by N.C. Gen. Stat. § 143-134.1. The UCBOE specifically reserves the right to withhold additional funds as authorized by this Contract and N.C. Gen. Stat. § 143-134.1. The Vendor may pay each subcontractor no later than seven days after receipt of payment from the UCBOE and in accordance with N.C. Gen. Stat. § 143-134.1 the amount to which the subcontractor is entitled, reflecting percentages actually retained from payments to the Vendor on account of the subcontractor's portion of the Work. The Vendor shall, by appropriate agreement with each subcontractor, require each subcontractor to make payments to sub-subcontractors in a similar manner and in accordance with N.C. Gen. Stat. § 143-134.1.
11. The Vendor shall use and submit applications for payment using a form reasonably satisfactory to UCBOE ("Application for Payment"). The Contractor shall submit with each Application for Payment a completed "Statement of Sales Tax Paid" and "Minority Business Enterprise" documentation in a form acceptable to UCBOE.

III. Additional Standard Term and Condition for Designer Contracts (which include Architectural, Engineering, Surveying, and Technical Services)

Additional Insurance. In addition to the insurance required pursuant to Section 22 of the Standard Terms and Conditions for All Contracts, the Vendor certifies that it currently has and agrees to purchase and maintain during its performance under the Contract the following insurance from one or more insurance companies acceptable to UCBOE and authorized to do business in the State of North Carolina: Professional liability insurance in commercially reasonable amounts as reasonably determined by UCBOE.

IV. Additional Standard Terms and Conditions for Information Technology Contracts

1. Definitions.
   "Hardware" means the hardware the Vendor utilizes in the Hosted Environment for delivery and maintenance of the Hosted Software Services.
   "Hosted Environment" means the Hardware, system software, hosting support software, network connectivity, and facility used by Vendor to support the Hosted Software Services.
   "Hosted Software Services" means the application, including the Hosted Software and any applicable Third-Party Software, as run on the Hosted Environment.
   "Hosted Software" means the software owned and controlled by Vendor or Vendor's third-party contractor that supports the Hosted Software Services.
   "Support Services" means application and technical support required to maintain the performance, uptime and connectivity of the Hosted Software Services for UCBOE access and use, including without limitation, telephone support, error correction, maintenance, and installation of Updates and Upgrades to the Hosted Software.
   "Updates" means (i) modifications to or releases of the Hosted Software that (a) add new features, functionality, and/or improved performance, (b) operate on new or other databases, operating systems, or server platforms or (c) extend the Hosted Software functionality to take advantage of advances in coding language, hardware, network or wireless infrastructures; and (ii) deviation corrections, bug or error fixes, patches, workarounds, and maintenance releases.
   "Upgrades" means any new version or new release of the Hosted Software typically provided on an annual or bi-annual basis by the Vendor that includes new features, functions, support or service that were not in place with the immediately prior version.
2. Grant of License. Vendor grants to UCBOE for the term of this Contract a non-exclusive, non-transferable license to access and use over the internet the Hosted Software (the "License").
3. Updates and Upgrades. Vendor will make certain limited and applicable Hosted Software Updates and Upgrades available to UCBOE at no additional cost. All such Updates and Upgrades shall automatically become subject to the benefits and terms of this Contract and shall automatically be considered part of the License granted under this Contract.
4. Security. Vendor's Hosted Environment shall maintain security measures in place to help protect against the loss, misuse, and alteration of the Hosted Software Services, and specifically the Confidential Information provided to Vendor by UCBOE.
5. Warranties. Vendor warrants the following: (a) Vendor has the full authority to grant the License; (b) the Hosted Software is free from material defects or viruses; (c) the Hosted Software contains no disabling devices; and (d) the Hosted Software conforms to all material specifications set forth in the documentation and any other written material provided to UCBOE for any purpose. Without limiting any other remedies available to UCBOE under this Contract, at law or in equity, in the event that any Hosted Software does not conform to the warranties set forth for the Hosted Software herein, Vendor shall, at UCBOE's option, promptly correct or replace such Hosted Software and, in either case, Vendor shall perform any Support Services or other work required to restore the Hosted Software to the state that existed prior to any such breach, all at Vendor's expense. UCBOE reserves the right to reject the Hosted Software and to hold Vendor responsible for any loss, direct or indirect, caused by any such breach of warranty. In the event Vendor is or becomes aware of a problem with any item of Hosted Software, Vendor shall notify UCBOE upon such determination. Acceptance or use of the Hosted Software shall not constitute a waiver of any claim under any warranty.
6. Effect of Termination and Orderly Transition. Upon termination or expiration of this Contract for any reason, Vendor will cooperate in good faith with UCBOE to provide for an orderly transfer of the Goods and Services

and Confidential Information to UCBOE or UCBOE's successor vendor ("Orderly Transition") and according to the terms of this section.

a. Scope of Work for Orderly Transition. Within thirty (30) days of notification by UCBOE that it will transfer Goods and Services to itself or a successor vendor, the parties will create and execute a scope of work document detailing tasks, the responsible parties for individual tasks, and timeframes for completion of tasks necessary to complete an Orderly Transition. The final, executed Orderly Transition scope of work shall be incorporated into this Contract and become subject to its terms. Vendor's failure to (a) cooperate in developing the Orderly Transition scope of work, (b) execute an Orderly Transition scope of work, or (c) abide by the executed Orderly Transition scope of work shall be deemed a material breach of this Contract.

b. Time Frame. Unless otherwise mutually agreed in an executed Orderly Transition scope of work, Vendor shall continue to provide Goods and Services while UCBOE migrates its Confidential Information from Vendor's Hosted Software Services in the Orderly Transition process. Vendor agrees that, as part of the Orderly Transition process and within the specified time frame, it will transfer to UCBOE all of the Confidential Information provided to Vendor by UCBOE pursuant to this Contract. Vendor will provide the Confidential Information in commercially reasonable electronic format as agreed in the Orderly Transition scope of work at no additional cost.

c. Time and Material Costs Only. UCBOE will be obligated to pay for time and materials at a reasonable hourly rate of no more than $75/hour for the Orderly Transition. No other fees will be assessed for the Orderly Transition. Fees shall be agreed upon in advance as part of developing the scope of work referenced in subsection (a) above.

d. Destruction of Confidential Information after Orderly Transition. Unless otherwise mutually agreed in an executed Orderly Transition scope of work, Vendor agrees that after returning all Confidential Information to UCBOE pursuant to subsection (b) above it will destroy all remaining copies of Confidential Information and back-up Confidential Information in its possession, contained in or on any medium (such as a storage area network or "SAN") or as may be stored offsite, within thirty (30) days of completion of Orderly Transition. Vendor shall provide UCBOE with a detailed summary of the destruction process and standards to be utilized by Vendor with respect to the Confidential Information, and UCBOE shall approve such process and standards prior to Vendor commencing such destruction.

7. Intellectual Property Warranty. In addition to the warranties set forth elsewhere in this Contract with respect to the Goods and Services, Vendor expressly represents, warrants and covenants that neither the furnishing of Hosted Services to UCBOE hereunder, nor does the Hosted Software, violate, in whole or in part, any provision of any law, common law or regulation concerning copyrights, trade secrets, trademarks, tradenames, service marks, patents or other provisions regulating or concerning intellectual property rights.
8. Additional Indemnification. To the fullest extent permitted by law, Vendor shall indemnify, defend and hold harmless UCBOE, its and directors, officers, managers, employees and agents, from all suits, claims, costs, damages and other liabilities, including reasonable attorneys' fees as incurred by counsel of UCBOE's choice, relating to or arising from (a) Vendor's failure to maintain the security and integrity of Confidential Information, the Hosted Software Services and the Hosted Environment; (b) any claim for infringement of any copyright, trade secret, trademark, tradename, service mark, patent, or other law or regulation concerning intellectual and/or proprietary property rights; and (c) any claims by third party interests in the Hosted Software.
9. Data Use. Notwithstanding the foregoing, Vendor acknowledges and agrees that all Confidential Information is proprietary to and owned exclusively by UCBOE, whether provided in tangible or electronic form and whether entered into any software or Hosted Software Services owned or licensed by Vendor (including without limitation the Hosted Software and Hosted Software Services) or otherwise provided in connection with any products provided and services performed by Vendor (including without limitation the Goods and Services) and whether to, by or through a Vendor-affiliated ASP or other Hosted Software Services. Furthermore, Vendor shall not sell, market, or commercialize Confidential Information, create derivative products or applications based on Confidential Information or otherwise use Confidential Information in any manner unrelated to the performance of Vendor's obligations under the Contract. Vendor shall not share Confidential Information with any parent or subsidiary company of Vendor or any other Vendor-affiliated entity without the express prior written consent of UCBOE detailing the scope of allowable disclosure. Vendor agrees that if it breaches this

section, UCBOE may, at its option, pursue any or all of the following remedies: (a) immediately terminate this Contract without liability to Vendor; (b) seek an injunction without posting a bond; and (c) pursue whatever other remedies may be available to it at law, in equity or pursuant to this Contract.

EXHIBIT 1

SCOPE OF WORK

PART 1-GENERAL

Union County Public Schools is soliciting bids for HVAC Rooftop Unit Replacements at Wesley Chapel Elementary School located at 110 Potter Road South, Monroe, NC 28110.

Contractor is to provide all labor, equipment, materials, permits, fees, inspections, etc. to provide a turnkey project as indicated on the drawings and specifications provided by Optima Engineer, P.A. (Exhibit 2). Permits and Inspections shall be provided to assigned UCPS Project Coordinator.

Note: Drawings are provided to give a general description of the Work. Contractor is to visit the site and field verify all existing conditions that may affect design and layout of this project prior to preparation of submittals.

Contractor shall comply with all current local, state, and national codes and regulations. This includes, but not limited to, complying with all ADA requirements. In the event of a conflict between the Scope of Work and code regulations, the Contractor shall notify the Engineer for direction.

Contractors shall be properly licensed within the state of North Carolina to complete work identified within the bid documents, have successfully completed projects of this type and size for a minimum of 5 years, and be able to provide references within 24 hours of request.

Additional Information

Chemicals are currently being handled through Southwest Engineers. Contact Information will be provided to awarded Contractor.

All roof penetrations must be performed by the roofing manufacturer that currently holds the warranty. Contractor shall contact the assigned UCPS Project Coordinator for contact information, if needed.

Existing pipe hangers and supports may be reused provided the existing spacing complies with code and is determined by Contractor to be in useable condition.

Commissioning will be handled by Owner.

PART 2-SAFETY

Contractor is solely responsible for safeguarding the project areas through the duration of the project including, but not limited to, barricades and snow fencing.

The Contractor may setup on site at a location authorized by the assigned UCPS Project Coordinator. Any equipment or supplies left on school property shall be securely locked. UCPS will not be responsible for damages or theft of Contractor's or 3rd party (i.e. rental equipment) property.

Contractor shall require all employees to abide by the OSHA safety guidelines. A written safety policy shall be provided to the assigned UCPS Project Coordinator within 24 hours of request.

Contractor shall perform due diligence to ensure all representatives of the Contractor including, but not limited to, subcontractors are Covid free prior to arrival.

All representatives of Contractor shall dress appropriate for school environment and perform work in a professional manner. Compliance is at the sole discretion of Union County Public Schools. Any individual not in compliance will be asked to leave Union County Public School property.

There are not to be any drugs, firearms, tobacco, or weapons on school property.

Contractor's Project Manager shall provide daily, to office of worksite, a list of employees working onsite.

PART 3-WARRANTY

Refer to Draft Contract for Warranty Information (Exhibit 3).

Contractor is responsible for damages to UCPS property as a direct result of this project. Contractor shall repair, replace to the fullest extent as needed to restore the property to the original state at no cost to Union County Public Schools.

PART 4-PROJECT SCHEDULE

January 2024 Notice to Proceed anticipated for release (contact Procurement Lead if not received).

Interior Work may be performed during operating hours provided no interruption to the students or staff. Exterior Work can take place anytime. Existing HVAC system must remain in operation until the change over takes place. All work is to be closely scheduled with assigned UCPS Project Coordinator to ensure no disruption to school activities.

Contractor shall list the number of consecutive calendar days required for completion.

Contractor shall appoint a Project Manager to be the sole point of contact through the duration of the project. The Project Manager shall be fluent in the English Language (speaking and writing). The Project Manager shall be easily accessible via telephone and email. At minimum, a status update shall be provided to the assigned UCPS Project Coordinator on biweekly.

PART 5-ALLOWANCE FUNDS

Definition: A designated amount of funds included in the contract amount for unforeseen conditions.

When an unforeseen condition arises, Contractor is to submit a written request for the amount of funds needed. The request shall be accompanied with backup documentation for the request (i.e. materials and labor quotes).

If approved, UCPS is to provide a signature of approval to the Contractor.

All unused funds will be credited to UCPS at the end of the project.

Amount of Allowance Funds allocated to this project is $20,000.00.

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COST PROPOSAL/EXECUTION OF PROPOSAL

Wesley Chapel Elementary School
Rooftop Unit Replacement (HVAC)
BID NO. 4-97380026

By submitting this proposal, the potential contractor certifies the proposal is signed by an authorized representative of the firm.

The cost and availability of all equipment, materials, and supplies associated with performing the services described herein have been determined and included in the proposed cost.

All labor costs, direct and indirect, **sales tax, etc**. have been determined and included in the proposed cost.

The offeror is aware of prevailing conditions associated with performing these services.

The potential contractor has read and understands the conditions set forth in this bid and agrees to them with no exceptions.

Therefore, in compliance with this Request for Proposals, and subject to all conditions herein, the undersigned offers and agrees, if this proposal is accepted within **60** days from the date of the opening, to furnish the subject services for a cost not to exceed:

BASE BID (ROOFTOP UNITS)	**$**_____	_____***CCD**
ALTERNATE 1 (AIR HANDLING UNIT)	**$**_____	_____***CCD**
ALTERNATE 2 (VAV BOXES)	**$**_____	_____***CCD**
ALLOWANCE FUNDS	**$** 20,000.00	
ALL INCLUSIVE TOTAL	**$**_____	_____***CCD**

*CCD: Consecutive Calendar Days required to achieve Final Completion from issuance of Notice to Proceed

ADDENDA ACKNOWLEDGEMENT

ADDENDUM 1: _____ ADDENDUM 2: _____ ADDENDUM 3: _____

EXECUTION

OFFEROR: _____FEDERAL ID NO._____

LICENSE DESCRIPTION: _____LICENSE NO._____

ADDRESS: _____CITY, STATE, ZIP _____

TELEPHONE NUMBER: _____MOBILE: _____EMAIL: _____

BY: _____ DATE: _____TITLE: _____
(Signature)

_____
(Typed or printed name)

EXHIBIT 2

Specifications and Drawings by Optima Engineering, PA

Minority Business Outreach

Instructions to Bidders

Supplementary Conditions (ITB)

Supplementary Conditions of Contract AIA 101-2017

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SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1: GENERAL

1.1 RELATED PROVISIONS

a. The requirements of the general conditions and of Division 01 apply to that portion of the work specified in this section.

b. These specifications and the accompanying drawings shall include the furnishing of all labor, tools, materials, fixtures, transportation, appurtenances and service necessary and incidental to the installation of a complete and operative system as indicated and intended on the Drawings and as herein specified.

c. Contractor shall coordinate the work and equipment of this division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, etc., which is required by the work of this Division of the Specifications, shall be provided by this Division unless otherwise indicated.

d. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 DESCRIPTION OF THE WORK:

a. Work included under this Division includes installation of a new cooling and heating system and associated electrical system and controls system. The systems shall be installed complete, with boilers, piping, chiller, pumps and auxiliaries as hereinafter called for. Miscellaneous items including conduits, concrete slab, etc., are to be provided as indicated.

b. It shall be the responsibility of the Contractor to provide a complete and operating system according to the true intent and meaning of the plans and specifications and all pipe, controls and equipment, etc.

1.3 DEFINITION

a. The word "Contractor" as used in this Section of the Specifications refers to the HVAC Contractor unless specifically noted otherwise. The word "provide" means furnish, fabricate, complete, install, erect, including labor and incidental materials, necessary to complete in place and ready for operation or use the items referred to or described herein, and/or as shown or referred to on the Contract Drawings.

1.4 HVAC CONTRACTOR'S QUALIFICATIONS

a. It is assumed that the contractor has had sufficient general knowledge and experience to anticipate the needs for a construction of this nature. The contractor

shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by Code, law or regulations shall be provided whether or not specified or specifically shown.

b. All work must be done by first class and experienced mechanics properly supervised, and it is understood that the Engineer has the right to stop any work that is not being properly done and has the right to demand that any incompetent workman be removed from the job and a competent workman be substituted therefor.

c. All work must be done in strict accordance with standards of AME, ASHRAE and the building laws of all character in force in the locality where the apparatus is being installed. All work must also be in accordance with rules and regulations of the National Board of Fire Underwriters.

1.5 DUTIES OF CONTRACTOR

a. Contractor is responsible for familiarizing himself with the details of the construction of the building. Work under these specifications installed improperly or which requires changing due to improper reading or interpretation of building plans shall be corrected and changed as directed by Engineer without additional cost to the Owner.

b. Contractor shall leave the premises in a clean and orderly manner upon completion of work, and shall remove from premises all debris that has accumulated during the progress of the work. The HVAC Contractor shall have the permanent HVAC systems in sufficient readiness for furnishing temporary climatic control at the time the building is enclosed. The HVAC systems control shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishers of the building. A building shall be considered enclosed when it has windows installed and when doorways and other openings have protection which will provide reasonable climatic control. The appropriate climatic condition shall be jointly determined by the Contractor and the Architect. Use of the equipment in this manner shall in no way affect the warranty requirements of the Contractor.

1.6 CODES, RULES, PERMITS AND FEES

a. The contractor shall give all necessary notices, obtain all permits and pay all government sales taxes, fees and other costs including utility connections or extension, in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates for inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

b. The contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, ordinances, rules and regulations as required to complete the project in accordance with the intent of the drawings.

c. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of all governmental departments having jurisdiction.

1.7 SURVEYS AND MEASUREMENTS

a. The contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check correctness of same as related to the work.

b. Should the contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and Specifications, he shall notify the Architect and shall not proceed with his work until he has received instructions from the Architect.

1.8 PLANS

a. Except where dimensions are shown, mechanical plans are diagrammatic; see Architectural drawings for building dimensions and locations of windows, doors, ceiling diffusers, lights, etc. The plans are not intended to show each and every fitting, valve, pipe or pipe hanger, or a complete detail of all the work to be done, but are for the purpose of illustrating the type of system, pipe and duct sizes, etc. and special conditions considered necessary for the experienced mechanic to take off his material and lay out his work. Contractor shall be responsible for taking such measurements as may be necessary at the job, and adapting his work to the local conditions.

1.9 DRAWINGS AND SPECIFICATIONS

a. Plans are diagrammatic, and it sometimes occurs that conditions exist in buildings which require certain changes in drawings and specifications. In event that such changes are necessary, the same are to be made by Contractor without expense to the Owner, provided however, that such changes, do not require furnishing more material or performing more labor than the true intent of the drawings and specifications demand.

b. It is understood that while the drawings are to be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear on the drawings or in the specifications will be fully explained if application is made to the Engineer. Should however, conditions arise where in the judgment of the Contractor certain changes would be advisable. Contractor will communicate with Engineer and secure approval of the changes before going ahead with the work.

c. The electrical and mechanical systems for this job have been designed on the basis of the mechanical equipment listed or data given herein or on the drawings. It shall be the responsibility of the Contractor to determine that the electrical service outlets, wiring, conduit and all overcurrent protective and safety devices furnished are

adequate to meet Code Requirements for the equipment which he proposes to use. Changes required in the electrical system to accommodate the proposed mechanical equipment shall be worked out and the details submitted for approval. The cost of making the necessary changes to the electrical system shall be the responsibility of the Contractor.

1.10 SHOP DRAWINGS

a. Refer to Division 01.

b. All items submitted to Architect for review shall bear stamp or notation indicating contractor's prior review and approval.

c. Any Electrical or other changes required by substituted equipment to be made at no change in contract price.

d. Submit manufacturer's certified performance data for all equipment.

e. Coordinate installation drawings with other parts of the work, whether specified in this Division or other Divisions.

f. Approval of shop drawings by the Engineer shall not relieve the Contractor from his obligation to provide equipment, control, and operation to the true intent of plans and specifications.

g. The Contractor shall submit to the Engineer, within ten (10) days after approval of bids by the owner, a list indicating the manufacturer of all equipment and materials which he proposes to use. After that date, no substitution will be approved and all items shall be as specified.

1.11 SCAFFOLDING, RIGGING, HOISTING:

a. This contractor shall furnish all scaffolding rigging, hoisting, and services necessary to erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

1.12 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS:

a. Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract.

1.13 SLEEVES AND OPENINGS:

a. Contractor must have an experienced mechanic on the job before concrete slab floors or concrete masonry walls are poured or built into place, whose duty it shall be to locate exact positions of any and all holes necessary for future installation of his pipe work, ducts or equipment. Where pipes pass through concrete or masonry walls or floors, steel pipe sleeves shall be furnished. These shall be the same length as wall thickness and shall extend 1/2" above finished floors. Pipe sleeves in equipment room floors shall extend 3" above refinished floor. Pipe sleeves in equipment room

floors shall extend 3" above finished floor. Sleeves shall be placed in position by this Contractor.

b. This Contractor shall arrange for proper openings in the building to admit his equipment. If it becomes necessary to cut any portion of building to admit his equipment, portions cut must be restored to their former condition by this Contractor.

c. This Contractor will provide duct openings or chases in masonry or concrete; however, it is this Contractor's responsibility to advise exact dimensions, shape and locations of openings required in sufficient time for the Contractor to make necessary provisions. This Contractor shall be responsible for correct size and location of each opening for his equipment through these openings.

d. Wall openings that require a fire or smoke damper shall be made as nearly possible to the damper or duct size so that an angle frame can close the opening entirely.

e. Where pipes or ducts penetrate floors or partitions which are fire or smoke barriers, the integrity of the barrier shall not be compromised by such penetration.

1.14 CUTTING AND PATCHING:

a. The Contractor shall do all cutting, fitting and patching as required to install piping and equipment except openings through the roof shall be provided by the General Contractor. Patching shall be done by mechanics skilled in the various trades and work shall match the existing work.

b. All exposed openings in walls and floors for piping shall be core drilled. Cutting of holes by hand will not be allowed.

c. Provide all required protection including but not limited to, welding blankets, dust covers, shoring bracing and supports to maintaining structural integrity, safety and cleanliness of the work.

1.15 EXCAVATION AND BACKFILLING:

a. All excavation and backfilling, pudding and tamping required to properly install work under this contract shall be done by this Contractor.

c. Backfill shall be clear of rocks and trash. Backfilling shall be water tamped so as to provide firm footing for finish work, and shall be maintained at proper level for duration of the Contract. No backfilling shall be done until work to be covered has been inspected. Excessive excavation material shall be deposited on site and leveled as directed by the engineer.

1.16 POURED IN PLACE CONCRETE WORK:

a. Furnish and install all concrete work required for the construction of anchors, guide bases and elsewhere as indicated on the Drawings. Refer to appropriate Section in Division 3 for specification requirements.

1.18 STORAGE OF MATERIALS:

a. Equipment, ductwork, piping, and other equipment stored on site shall be protected from mud, dust, debris, weather, vermin, and construction traffic.
b. Equipment, ductwork, piping, and other equipment shall be capped or otherwise covered to prevent water, dust, and debris intrusion. Cellophane membrane may be used for duct and equipment with care taken to maintain the seal integrity. Covering shall be replaced if seal is disturbed. Covering shall be removed only when necessary.
c. Where pipe or ductwork becomes damaged by rust, dirt, dust, mud, or construction debris, it must be thoroughly cleaned and prepared to a like-new condition before installation.
d. Porous materials such as duct liner and insulation that become saturated with water shall be discarded and replaced.
e. Any equipment and/or materials affected (including aesthetically) as a result of improper storage shall be cleaned or replaced at contractor expense.

PART 2: PRODUCTS

2.1 MATERIALS

a. Provide equipment complete with all components and accessories necessary to its satisfactory operation.

b. Listing of a manufacturer's name in this Division does not infer conformity to all requirements of the Contract Documents, nor waive requirements thereof.

PART 3: EXECUTION

3.1 BELT DRIVES

a. V-belt drives shall be rated at not less than 200% of nominal motor horsepower.

b. Motor sheaves shall be fixed pitch type.

c. Scheduled fan static pressures are estimated. Provide one extra drive per device as required to allow adjustment to deliver scheduled air quantities against actual system resistance.

d. Provide guards for all belt drives not enclosed within equipment housings. Provide openings in guard at driving and driven sheaves for use of revolution counter.

3.2 MAINTENANCE AND OPERATING INSTRUCTIONS

a. Upon completion of all work, the Contractor shall furnish a complete set of operating instructions for all equipment. Such instructions shall be diagrammatic in form on heavy white paper, suitably framed, protected with glass and hung where

directed by the owner. A preliminary draft of the instruction sheets shall be submitted to the engineer for approval before making same.

b. Manufacturer's instruction books, card, etc., (to each individual piece of equipment furnished under this contract) shall be furnished to the owner. These shall contain instructions for the operation and maintenance of all equipment. Where such is not furnished by the manufacturer, the contractor shall give written instructions to the owner for the maintenance of the equipment involved.

3.3 DUCTS, PLENUM, ETC.

a. As indicated on drawings, provide a system of ducts for supplying returning and exhausting air from various spaces. All details of the ductwork are not indicated and the necessary bends, offsets and transformations must be furnished whether shown or not.

b. All sheet metal ducts, casing, plenums, etc., of sizes indicated, shall be constructed from prime galvanized sheet steel, and shall be in accordance with or equal to standards set forth in latest issue of SMACNA low velocity duct manual for gauges of materials, (2" pressure), workmanship, method of fabrication and erection.

c. All uninsulated panels of ducts over twelve inches (12") wide shall be cross-broken, except on plenums, which shall be braced with angle iron as required to prevent breathing.

d. All ductwork must present a smooth interior and joints must be airtight. Where there is evidence of undue leakage at the joints in low pressure ducts, they shall be sealed with cement similar to Foster 30-02.

e. Depending upon space requirements, round or square elbows may be used as required or at the Contractors option in low velocity ducts. All elbows shall be constructed for minimum pressure drop. All elbows with an inside radius less than 3/4 the width of the duct must be fitted with multiple double thickness turning vanes.

f. No transformations or offsets shall be made with a slope greater than (7 to 1), space conditions permitting.

g. Where indicated on drawings, ductwork is to be lined with flexible fiberglass acoustics material weighing not less than 1 1/2 lb. per cubic foot and having a flame spread classification of not more than twenty-five (25) as listed under Underwriters Laboratories. Liner shall be applied according to SMACNA duct liner standard. Thickness shall be as indicated on the drawings. Duct sizes on plan are inside clear sizes, increase the actual sheet metal size accordingly in sizing the duct.

h. The lining shall be secured to the ductwork with a suitable adhesive and with mechanical fasteners center. Liner shall be cut such that adjacent sections of insulation butt together and are sealed with Foster 30-02 joints.

i. All duct connections to and from all centrifugal fans or cabinets containing fans, shall be made with fabric equal to "Ventfab" as made by Ventfabrics, Inc., not less

than four inches (4") long secured by peripheral iron straps holding fabric in galvanized iron, except as otherwise noted.

j. Vertical ducts shall be supported by means of an angle iron frame riveted to the ductwork on at least two (2) sides. Horizontal runs of ductwork shall be supported on not more than 8'-0" centers as required.

k. Manual volume and splitter dampers shall be furnished and installed where shown and where necessary for proper regulation of the air distribution. A quadrant and set screw equal to "Ventlock" #641 shall be installed for all dampers which are concealed above plaster or gypsum board ceilings, or behind the masonry construction, furnish and install concealed regulators ("Ventlock" #666) with chrome cover plate.

l. All ductwork shall operate without chatter and vibration, and shall be free from pulsations.

m. See section 233113 for metal ductwork requirements.

3.4 ACCESS DOORS OR PANELS

a. Provide duct access doors of approved construction at any apparatus requiring service and inspection. Doors shall suit finish in which installed.

b. Access doors in rated walls or assemblies shall be rated as required to maintain rating of assembly. Rated access doors shall bear U.L. Label.

3.5 CLEANING DUCT SYSTEM

a. Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire systems with all control devices wide open.

3.6 ITEMS OF ELECTRICAL EQUIPMENT

a. All electrical work shall be done by properly licensed electrical mechanics in accordance with Division 26 of the specifications under supervision of a licensed Electrical Contractor as approved by the Architect.

b. The Electrical Contractor shall provide all power wiring to motor starter and/or disconnect switch and from starter/disconnect switch to motor. The Mechanical Contractor shall provide all control wiring, low voltage or line voltage, as required for the operation of all mechanical equipment. All control devices such as motor starters, thermostats, switches, etc. shall be provided by the Mechanical Contractor.

c. All motor starters shall be provided with a “hand-off-auto” switch on the starter cover.

d. All items of mechanical equipment electrically operated shall be in complete accordance with electrical division of the specifications. Mechanical equipment,

other than individually mounted motors, shall be factory prewired so that it will only be necessary to bring connections to a single set of terminals.

e. Mechanical equipment electrical components shall all be bonded together and connected to electrical system ground.

f. All mechanical equipment shall be U.L. listed and labeled as a complete package, not through individual components or parts. Provide required 3rd party field UL listing services as required to comply.

3.7 WARRANTY AND SERVICE

a. Upon completion of all work, the contractor shall check the system out so that all motor bearings are greased as required and have all systems balanced. He shall be responsible for original service, of starting the system up, and providing one set of replacement filters after final acceptance.

b. Refer to equipment specifications for specific warranty information.

3.8 INSPECTION AND ACCEPTANCE TEST

a. The project will be checked periodically as construction progresses. The contractor shall be responsible for notifying the Engineer at least 48 hours in advance when any work to be covered up is ready for inspection. No work will be covered up until approved by the Engineer.

b. Upon completion of erection of all equipment and work specified herein and shown approved shop drawings, and at the time designated by the engineer, the contractor shall start all apparatus, making necessary tests as directed and as specified herein, and make adjustments of all parts of all equipment before acceptance of equipment by the owner. The contractor must demonstrate to the owner, by performance, that all equipment operates as specified and meets the guarantee called for.

c. Tests shall include satisfactory evidence that all systems operate as called for on the drawings, and that all pieces of equipment operate at specified ratings under specified operating conditions.

d. The contractor shall furnish all fuel and power required for these purposes, and provide the proper and necessary help required to operate the system while tests are being made.

e. All drainage piping shall be tested by filling with water to a point 10' above the underground drains or to point of discharge to grade and let stand thus filled for 3 hours.

f. Tests on all pipe work shall be subject to the inspection of the Engineer. He shall be given 24-hours notice when a section pipe is to be tested and the test shall not be removed until permission is given by the Engineer.

3.9 AS BUILT DRAWINGS

b. This contractor shall keep on the job at all times, a clean set of contract drawings in blueprint form. As the job progresses, any and all deviations from the arrangements, piping runs, equipment locations, etc., shown on the bid prints shall be marked on this set with red ink. These prints shall not be used for any other purpose than to be marked up as "As-Built" Drawings.

3.10 OWNER TRAINING

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 the equipment listed below:
   1. DDC Control Systems
   2. AHUS/RTUS

B. Extent of Training:

   1. Base extent of training on scope and complexity of equipment installed 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 the number days of training indicated below.
         1) DDC Control Systems - 8 hours
         2) Air Handlers/RTUS - 8 hours

      b. All training shall occur before end of warranty period.

C. Training Schedule:

   1. Schedule training with Owner **20** business days before expected Substantial Completion.
   2. Training shall occur within normal business hours at a mutually agreed on time. Unless otherwise agreed to, training shall occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions.
   3. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

   1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
   2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
   3. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
   4. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

F. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

    a. Daily operators.
    b. Advanced operators.
    c. System managers and administrators.

G. Training Outline:

1. Submit training outline for Owner review at least **10** business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

H. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.
2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.
5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

I. Training Content:

1. Basic operation of each system.
2. Understanding each unique product type installed including performance and service requirements for each.
3. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.

END OF SECTION 230500

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 ac 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 requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

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: Energy 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 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

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. Energy- and 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.

2.6 VARIABLE FREQUENCY DRIVES

A. Scope
   a. This section provides requirements for AC inverter type adjustable frequency, variable speed drives or herein identified as AC drives for use with (NEMA B, NEMA A, NEMA C, NEMA E, synchronous) design AC motors.

B. Manufacturers
   a. The manufacturer of the AC drive shall be a certified ISO 9001 quality facility. Manufacturers = ABB, Danfoss (Graham) or Yaskawa

   b. All VFD’s in project shall be by the same manufacturer. This shall include all pumps and air handler fans, where indicated on the plans.

C. Regulatory Requirements
   a. UL listed.
   b. EN Standard CE marked for the following:
      Low Voltage Directive (73/23/EEC)
      EN50178
      EMC Directive (89/336/EEC)
      EN61800-3 Adjustable Speed electrical power drive systems Part 3
   c. Designed, constructed and tested in accordance with NEMA, ICS, NFPA and IEC standards.

D. Environmental Requirements
   a. The AC drive construction ½ hp to 5 hp 230V and 1 hp to 7.5 hp 480V shall be IP20/open according to Standard EN50178. 7.5 hp to 10 hp 230V and 10 hp to 20 hp 480V shall be Type 1. Both are designed to operate as Pollution degree 2 conforming to IEC 664-1, EN50718 and NEMA ICS-1. Drives above 20 hp 480V and 15 hp 230V shall meet Type 1 Pollution degree 3 according to IEC 664-1, EN50718 and NEMA ICS-1.
   b. The AC drive will be designed to operate in an ambient temperature from 0 to 40 degrees C (32 to 104 degrees F).
   c. The storage temperature range shall be -25 to 70 degrees C.
   d. The maximum relative humidity shall be 95% at 40 degrees C, non-condensing.
   e. The AC drive will be rated to operate at altitudes less than or equal to 1000m (3300 ft).
   f. The AC drive will meet the IEC 68-2-6-vibration specification.
   g. The AC drive shall be designed and constructed to be of finger safe construction with enclosure open to operator access according to IP20 standards.

E. Related Document

   a. Division 26 – Electrical

F. Equipment

   a. General Description
      i. The AC drive shall utilize soft switching technology and voltage vector control.
      ii. The AC drive mfr shall provide a harmonic analysis showing compliance with IEEE-519.

      iii. The AC drive shall have the Hand/Off/Auto function.

      iv. The AC drive shall have a VFD/bypass system design that is serviceable while operating in bypass mode. This includes a drive disconnect to ensure service personnel safety, a 2-contactor bypass for full speed operation, and an isolation barrier to ensure service personnel safety and repair of the drive while operating in full speed bypass mode. Bypass shall have a separate integral disconnect.

      v. Each AC drive shall have voltage/single phase protection of the drive and bypass system to ensure continued operation after utility power failures. Drive protection modules shall be ATC Diversified Electronics SLU-100-ASA 0315PB or equivalent. Protection modules shall monitor incoming 480V 3-phase power and shall interrupt 120V control circuit. Install modules in drive cabinet.

      vi. The AC drive shall have common control in both drive and bypass modes.

      vii. Each AC drive shall have M.O.V. lightning protection.

      viii. The AC drive shall have safety interlocks for all modes of operation.

      ix. A manufacturer's warranty shall be provided on all materials and workmanship of no less than 1 year from the date of start-up or 18 months from date of shipment.

   b. Ratings

i. The AC drive shall be designed to operate from an input voltage of 208/230 +/-15% VAC or 400/460 +/-15% VAC.

ii. The AC drive shall operate from an input voltage frequency range from 47.5 to 63 Hz.

iii. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.

iv. The efficiency of the AC drive at 100% speed and load shall not be less than 96%.

v. The constant torque overtorque capacity will be 150% for 1 minute (The variable torque overtorque capacity will be 110% for 1 minute).

vi. The output switching frequency of the drive will be randomly modulated and selectable at 2 kHz, 4 kHz, 12 kHz or 16 kHz depending on drive rating for low noise operation.

vii. The output frequency shall be from 0.1 to 500 Hz (selectable at 50 Hz, 60 Hz, 200 Hz, 500 Hz).

viii. The AC drive will be able to provide rated motor torque at 0.5 Hz in a Sensorless Flux Vector mode using a standard motor and no tachometer feedback.

ix. See plans for information regarding SCCR rating for VFD's and electrical components for specific pieces of equipment.

c. Protection

i. Upon power-up, the AC drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, (dynamic brake failure), DC to DC power supply, control power, and the pre-charge circuit.

ii. The AC drive shall be protected against short circuits between output phases; between output phases and ground; on the control terminal outputs; and the internal supplies. The logic and analog outputs shall also be optically isolated.

iii. The AC drive shall have a minimum of power loss ride-through of 200 msec. The AC drive shall have the user-defined option of frequency fold-back to increase the duration of the power loss ride-through.

iv. The AC drive shall have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.

v. For a fault condition other than ground fault, short circuit or internal fault, an auto restart function will provide restart.

vi. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.

vii. A synchronized restart shall be provided that will catch a spinning motor by sensing the motor frequency and rotational direction and synchronize the AC drive's output prior to restarting.

viii. Upon loss of the analog process follower reference signal, the AC drive shall fault ad/or operate at a user defined speed set between software programmed low speed and high speed settings.

ix. The AC drive shall have solid state protection that is UL listed and meets UL 508C as a Class 20 overload protection and meets IEC 947. The adjustment shall be from 0.45 to 1.05 percent of the current output of the AC drive.

x. The AC drive shall have a thermal switch with a user selectable pre-alarm that will provide a minimum of 60 seconds delay before over temperature fault.

d. Operator Interface

i. The full English operator interface terminal will offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, drive menu parameters, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics will be shown.
ii. The AC drive keyboard will announce horsepower and voltage.
iii. The display shall be capable to be configured to display multiple parameters with numeric data that is selectable and scalable by the operator. A user defined display value proportional to output frequency shall be available. As a minimum the display values shall consist of speed reference, output frequency, output current, motor torque, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, motor speed and output power.

G. Execution

a. Installation

i. The installation shall be in compliance with the manufacturer's instructions, drawings and recommendations. The AC drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC drive(s).

ii. The contractor shall assume the responsibility for coordinating the purchased equipment with the motor served and with the automatic temperature control system, paying specific attention to the signal sent and received, the ground source and the required speed range.

iii. The manufacturer shall provide start-up of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for VFD field repair are not acceptable as commissioning agents. Start-up ser

vices shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Start-up shall include customer operator training at the time of the equipment commissioning.

iv. The VFD shall be mounted with operator interface between 4'-6" and 5'-6" above finished floor for visibility and accessibility.

H. Training

a. An on-site training session of (4) hours duration shall be provided by a representative of the AC drive manufacturer and shall included in the base bid for the project.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment (Note: Plastic Labels utilized in a return air plenum shall be listed and approved for use in a return air plenum):

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. 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-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. 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), plus the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. 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-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

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 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Major mechanical equipment shall include:

a. VAV Boxes
b. Air Handlers
c. All RTUs

3.3 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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 TAB to produce design objectives for the following:

1. Air Systems:

    a. Constant-volume air systems.
    b. Variable-air-volume systems.

2. Hydronic Piping Systems:

    a. Constant-flow systems.
    b. Variable-flow systems.
    c. Primary-secondary systems.

3. Steam systems.
4. HVAC equipment quantitative-performance settings.
5. Kitchen hood airflow balancing.
6. Laboratory fume hood airflow balancing.
7. Exhaust hood airflow balancing.
8. Space pressurization testing and adjusting.
9. Vibration measuring.
10. Sound level measuring.
11. Stair-tower pressurization testing and adjusting.
12. Smoke-control systems testing and adjusting.
13. Indoor-air quality measuring.
14. Existing systems TAB.
15. Verifying that automatic control devices are functioning properly.
16. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

P. TAB: Testing, adjusting, and balancing.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

    a. Submittal distribution requirements.
    b. The Contract Documents examination report.
    c. TAB plan.
    d. Work schedule and Project-site access requirements.
    e. Coordination and cooperation of trades and subcontractors.
    f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

G. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."

H. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.7.2.3 - "System Balancing."

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.

4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
6. Capacity: Calculate in tons of cooling.
7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser-water flow to each cell of the cooling tower.
2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser-water flow rate recirculating through the cooling tower.
6. Measure cooling tower pump discharge pressure.
7. Adjust water level and feed rate of makeup-water system.

3.14 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.15 PROCEDURES FOR BOILERS

A. If hydronic, measure entering- and leaving-water temperatures and water flow.

B. If steam, measure entering-water temperature and flow and leaving steam pressure, temperature, and flow.

3.16 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.

5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.17 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.18 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.

1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of

the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.

3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.
2. Verify that duct access is installed as required.
3. Verify that point of termination is as required.
4. Verify that duct air velocity is within the range required.
5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.19 PROCEDURES FOR EXHAUST HOODS

A. Measure, adjust, and record the airflow of each exhaust hood. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, explain why, in the report, and explain the test method used.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to achieve optimum results.

3.20 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.

C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.

1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.

2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
3. Test room pressurization first, then zones, and finish with building pressurization.

D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.

E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.

G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.21 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.22 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances (code required minimums must meet or exceed rates indicated on plans):

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Minus 5 to plus 10 percent.
2. Air Outlets and Inlets: minus 10 to plus 10 percent.
3. Heating-Water Flow Rate: minus 10 to plus 10 percent.
4. Cooling-Water Flow Rate: minus 10 to plus 10 percent.

3.23 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.24 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.

d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat coil static-pressure differential in inches wg.
g. Cooling coil static-pressure differential in inches wg.
h. Heating coil static-pressure differential in inches wg.
i. Outside airflow in cfm.
j. Return airflow in cfm.
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btuh.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btuh.
i. High-fire fuel input in Btuh.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btuh.
m. Motor voltage at each connection.

n. Motor amperage for each phase.
o. Heating value of fuel in Btuh.

I. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btuh.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btuh.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

J. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

K. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft..
    g. Indicated airflow rate in cfm.
    h. Indicated velocity in fpm.
    i. Actual airflow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

L. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Test apparatus used.
    d. Area served.
    e. Air-terminal-device make.
    f. Air-terminal-device number from system diagram.
    g. Air-terminal-device type and model number.
    h. Air-terminal-device size.
    i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary airflow rate as needed in cfm.
    d. Preliminary velocity as needed in fpm.
    e. Final airflow rate in cfm.
    f. Final velocity in fpm.
    g. Space temperature in deg F.

M. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Room or riser served.
    d. Coil make and size.
    e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Entering-water temperature in deg F.
    c. Leaving-water temperature in deg F.
    d. Water pressure drop in feet of head or psig.
    e. Entering-air temperature in deg F.
    f. Leaving-air temperature in deg F.

N. Packaged Chiller Reports:

1. Unit Data:

    a. Unit identification.
    b. Make and model number.
    c. Manufacturer's serial number.
    d. Refrigerant type and capacity in gal..
    e. Starter type and size.
    f. Starter thermal protection size.
    g. Compressor make and model number.
    h. Compressor manufacturer's serial number.

2. Water-Cooled Condenser Test Data (Indicated and Actual Values):

    a. Refrigerant pressure in psig.
    b. Refrigerant temperature in deg F.
    c. Entering-water temperature in deg F.
    d. Leaving-water temperature in deg F.
    e. Entering-water pressure in feet of head or psig.
    f. Water pressure differential in feet of head or psig.

3. Air-Cooled Condenser Test Data (Indicated and Actual Values):

    a. Refrigerant pressure in psig.
    b. Refrigerant temperature in deg F.
    c. Entering- and leaving-air temperature in deg F.

4. Evaporator Test Reports (Indicated and Actual Values):

    a. Refrigerant pressure in psig.
    b. Refrigerant temperature in deg F.
    c. Entering-water temperature in deg F.
    d. Leaving-water temperature in deg F.

e. Entering-water pressure in feet of head or psig.
f. Water pressure differential in feet of head or psig.

5. Compressor Test Data (Indicated and Actual Values):

a. Suction pressure in psig.
b. Suction temperature in deg F.
c. Discharge pressure in psig.
d. Discharge temperature in deg F.
e. Oil pressure in psig.
f. Oil temperature in deg F.
g. Voltage at each connection.
h. Amperage for each phase.
i. Kilowatt input.
j. Crankcase heater kilowatt.
k. Chilled-water control set point in deg F.
l. Condenser-water control set point in deg F.
m. Refrigerant low-pressure-cutoff set point in psig.
n. Refrigerant high-pressure-cutoff set point in psig.

6. Refrigerant Test Data (Indicated and Actual Values):

a. Oil level.
b. Refrigerant level.
c. Relief valve setting in psig.
d. Unloader set points in psig.
e. Percentage of cylinders unloaded.
f. Bearing temperatures in deg F.
g. Vane position.
h. Low-temperature-cutoff set point in deg F.

O. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.

e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

P. Cooling Tower or Condenser Test Reports: For cooling towers or condensers, include the following:

1. Unit Data:

a. Unit identification.
b. Make and type.
c. Model and serial numbers.
d. Nominal cooling capacity in tons.
e. Refrigerant type and weight in lb.
f. Water-treatment chemical feeder and chemical.
g. Number and type of fans.
h. Fan motor make, frame size, rpm, and horsepower.
i. Fan motor voltage at each connection.
j. Sheave make, size in inches, and bore.
k. Sheave dimensions, center-to-center, and amount of adjustments in inches.
l. Number of belts, make, and size.
m. Pump make and model number.
n. Pump manufacturer's serial number.
o. Pump motor make and frame size.
p. Pump motor horsepower and rpm.

2. Pump Test Data (Indicated and Actual Values):

a. Voltage at each connection.
b. Amperage for each phase.
c. Water flow rate in gpm.

3. Water Test Data (Indicated and Actual Values):

a. Entering-water temperature in deg F.
b. Leaving-water temperature in deg F.
c. Water temperature differential in deg F.
d. Entering-water pressure in feet of head or psig.
e. Leaving-water pressure in feet of head or psig.
f. Water pressure differential in feet of head or psig.
g. Water flow rate in gpm.
h. Bleed water flow rate in gpm.

4. Air Data (Indicated and Actual Values):

a. Duct airflow rate in cfm.
b. Inlet-duct static pressure in inches wg.
c. Outlet-duct static pressure in inches wg.
d. Average entering-air, wet-bulb temperature in deg F.
e. Average leaving-air, wet-bulb temperature in deg F.
f. Ambient wet-bulb temperature in deg F.

Q. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.

d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

R. Boiler Test Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.
f. Fuel type and input in Btuh.
g. Number of passes.
h. Ignition type.
i. Burner-control types.
j. Voltage at each connection.
k. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

a. Operating pressure in psig.
b. Operating temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Number of safety valves and sizes in NPS.
f. Safety valve settings in psig.
g. High-limit setting in psig.
h. Operating-control setting.
i. High-fire set point.
j. Low-fire set point.
k. Voltage at each connection.
l. Amperage for each phase.
m. Draft fan voltage at each connection.
n. Draft fan amperage for each phase.
o. Manifold pressure in psig.

S. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.

e. Model and serial numbers.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. If fans are an integral part of the unit, include the following for each fan:

a. Make and type.
b. Arrangement and size.
c. Sheave make, size in inches, and bore.
d. Sheave dimensions, center-to-center, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):

a. Total exhaust airflow rate in cfm.
b. Purge exhaust airflow rate in cfm.
c. Outside airflow rate in cfm.
d. Total exhaust fan static pressure in inches wg.
e. Total outside-air fan static pressure in inches wg.
f. Pressure drop on each side of recovery wheel in inches wg.
g. Exhaust air temperature entering in deg F.
h. Exhaust air temperature leaving in deg F.
i. Outside-air temperature entering in deg F.
j. Outside-air temperature leaving in deg F.
k. Calculate sensible and total heat capacity of each airstream in MBh.

T. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.25 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.26 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

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. Insulation Materials:
   a. Cellular glass.
   b. Flexible elastomeric.
   c. Mineral fiber.
   d. Phenolic.
2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied cloths.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

1.3 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroflex
2. Armacell
3. Certain Teed Corp.
4. Johns Manville
5. Knauf Insulation
6. Owens Corning

7. Pittsburg Corning Corp.
8. Dyplast Products

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
2. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

L. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

M. Phenolic:

1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Preformed Pipe Insulation: ASJ.

b. Board for Duct and Plenum Applications: ASJ.
c. Board for Equipment Applications: ASJ.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
2. Service Temperature Range: 0 to 180 deg F.
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants: Cellular-Glass, Phenolic, Products.

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: Color-code jackets based on system.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Finish and thickness are indicated in field-applied jacket schedules.
    b. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 4 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 6 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
c. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:
1. Provide 1” foam-core insulation on all chilled water pumps. Install pump insulation per foam-core insulation manufacturer’s pump insulation installation instructions. Include pump insulation installation instructions with insulation submittals.
2. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable

insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 75 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 75 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.10 PHENOLIC INSULATION INSTALLATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.12 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: Coat exposed outdoor flexible elastomeric insulation with two coats of manufacturer’s recommended protective white coating; or cover with aluminum jacketing all exposed outdoor flexible elastomeric insulation, in lieu of paint.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return, and outdoor air.
2. Indoor, exposed outdoor air.
3. Outdoor, concealed supply and return.
4. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Exhaust ductwork
4. Factory-insulated flexible ducts.
5. Factory-insulated plenums and casings.
6. Flexible connectors.
7. Vibration-control devices.
8. Factory-insulated access panels and doors.

3.15 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-air Ducts, Concealed (installed above ceilings):

1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0

B. Return Air Ducts, Concealed (installed above ceilings):

1. 1” thick flexible elastomeric duct liner for rectangular 18”x18”
2. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0 for round ductwork off 18”x18” return main.

C. Exposed Supply in Gym

1. Double wall type (1” liner).

D. Outside-Air Ducts:

1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0.

3.16 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Supply-air, return-air and outside-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

3.17 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, condenser bundles, heat-recovery bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles as recommended by the manufacturer.

D. Chilled-water pump insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
3. Flexible Elastomeric: 1 inch thick

E. Dual-service heating and cooling pump insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

F. Chilled-water expansion/compression tank insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.
3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

G. Dual-service heating and cooling expansion/compression tank insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.
3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

H. Heating-hot-water expansion/compression tank insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.
3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

I. Chilled-water air-separator insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.
3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

J. Heating-hot-water air-separator insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.

3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

K. Thermal storage tank insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Flexible Elastomeric: 1 inch thick.
3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

3.18 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.19 INDOOR PIPING INSULATION SCHEDULE

A. Condensate, Cold Water Make-up and Equipment Drain Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.

B. Chilled Water Supply and Return:

1. Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Phenolic: 1-1/2 inch thick.

C. Condenser-Water Supply and Return:

1. Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 1-1/2 inches thick.
c. Phenolic: 1 inch thick.

D. Heating-Hot-Water Supply and Return:

1. NPS 1-1/2” and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.

b. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
c. Phenolic: 1-1/2 inch thick.

2. NPS 2" and Larger: Insulation shall be the following:

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.
c. Phenolic: 2 inch thick.

E. Refrigerant Suction and Hot-Gas Piping:

1. Insulation shall be installed per the manufacturer's recommendations.

F. Dual-Service Heating and Cooling, 40 to 200 Deg F:

1. Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Phenolic: 1-1/2 inch thick.

3.20 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 3 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Phenolic: 1-1/2 inch thick.

B. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Phenolic: 1 inch thick.

C. Heating-Hot-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 3 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
c. Phenolic: 2 inch thick.

D. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be as recommended by the manufacturer.

E. Dual-Service Heating and Cooling:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 3 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Phenolic: 2 inch thick.

3.21 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.

B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.

C. Condenser-Water Supply and Return, All Sizes: Cellular glass, 2 inches thick.

D. Heating-Hot-Water Supply and Return, All Sizes: Cellular glass, 2 inches thick.

E. Dual-Service Heating and Cooling, All Sizes: Cellular glass, 2 inches thick.

3.22 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts, Plenums, and Piping, Concealed (installed above ceilings) and Exposed in Air Conditioned Occupied Spaces:

1. None.

D. Ducts, Plenums, and Piping, Exposed in Air Conditioned Utility Spaces (Conditioned Mechanical Rooms and Mechanical Rooms used as Return Air Plenums):

1. 8 ounce canvas with lagging adhesive.

E. Ducts, Plenums, and Piping, Exposed in Non-Air Conditioned Spaces (Boiler Rooms, et. al.):

1. PVC: 20 mils thick (N/A if installed in a return air plenum).
2. Aluminum, Smooth: 0.016 inch thick.

F. Equipment, Concealed (installed above ceilings):

1. None.

G. Equipment, Exposed (all applications):

1. PVC: 20 mils thick (N/A if installed in a return air plenum)
2. Aluminum, Smooth: 0.016 inch thick.

3.23 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. PVC: 20 mils thick.
2. Aluminum, Smooth: 0.016 inch thick.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth: 0.016 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Smooth with: 0.032 inch thick.

F. Equipment, Concealed:

1. None.

G. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Painted Aluminum, Smooth: 0.016 inch thick.

H. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Smooth with: 0.032 inch thick.

I. Piping, Concealed:

1. None.

J. Piping, Exposed:

1. PVC, Color-Coded by System: 20 mils thick.
2. Aluminum, Smooth: 0.016 inch thick.

3.24 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230700

SECTION 230900 - BUILDING AUTOMATION SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The required system will be Niagara Based and be added to existing N4 Server. All equipment will consist of approved products specified below. Contractor to provide needed quantities of product specified below based on jobsite visit and plans provided. All Graphics, Alarms, Trending and Scheduling shall be added to existing N4 server and match existing layout and function of other schools unless approved in writing by UCPS.

Contractor to provide job documentation, including System Layout, Comm bus layout, sequence of operation, point to point controller diagrams and all product data sheets. The documentation is to be provided via 3 hard copies and also place on FX server to be access via system graphics.

All Products to be warrantied for a period of 3 years from the date of purchase, all labor to be warrantied 1 year from Job Completion and Sign-off.

APPROVED PRODUCTS:

1. System to be IP based, all controllers now to be connected via UCPS Ethernet network. Contractor to provide switches listed below. UCPS will install and setup switches in existing IT closets located on each classroom wing. All Ethernet cable for HVAC equipment will be Cat-6 and orange in color. The Contractor will pull CAT-6 cable via existing cable tray from field controllers to new switches.

2. APPROVED PRODUCTS:
    1. VG-20 Controllers for Fan Coils
    2. VG-32 Controllers for Chillers, Boilers, Air Handling Units
    3. VC-20 Expansion Controllers for Chillers, Boilers, Air Handling Units
    4. FW-VAV Controllers for VAV Units
    5. A/CP-S Room Sensors for Fan Coils
    6. A/CP-S Room Sensor for Variable Air Volume and Air Handling Units
    7. EX3300-48 48 Port switch (1 Per Wing)
    8. FX-7021 Jace (Located in Mechanical Room and will be provided by UCPS)
    9. A/10K-CP-6 Duct Temp Sensors for Fan Coils
    10. RIXGA CT Switches for Fan Coil Fan Status (Fan Coils, Air Handling Units, Chillers, Boilers)
    11. PA Series JCI UL Listed Control Panels (if needed) Chiller, Boiler Plant
    12. A/10K-CP Immersion Sensors Chillers, Boilers

Company Name	Address Location	Primary Contact Phone	Primary Contact Email
Facility Systems Services Inc	P.O. BOX 1540,Matthews, NC 28106	Danny Fox 704-214-7810	dfox@fss-i.com

Platinum Building Automation	6527 Hudspeth Road, Harrisburg, NC 28075	Jason Williams 704-765-8503	jwilliams@platinumbuildingautomation.com
Environmental Controls	PO Box 481779 Charlotte, NC 28269	Brett Downs 704-995-4245	brettd@ecmsolution.com
Carolina Air Solutions	2900 Westinghouse Boulevard Charlotte NC,28273	Billy Garrison 704-506-9068	billy@carolinaairsolutions.com

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section includes control equipment for HVAC systems and all components for addition to the facility, including control components for terminal heating and cooling units not supplied with factory wired controls.

1.4 SYSTEM DESCRIPTION

A. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, to control the addition and existing mechanical systems. Add interlock wiring components to existing system as indicated on the drawings.

1.5 SEQUENCE OF OPERATION **REFER TO DRAWINGS M0.3 AND M0.4**

1.6 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. Each control device labeled with setting or adjustable range of control.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required

Clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.

2. Wiring Diagrams: Power, signal, and point to point control wiring. Differentiate between manufacturer-installed and field-installed wiring.

3. Details of control panel faces, including controls, instruments, and labeling.

4. Written description of sequence of operation.

5. Schedule of valves including leakage and flow characteristics.

PART 2 - PRODUCTS

2.1 Products

The Basis of design is the Facility Explorer system from JCI, Approved manufactures may bid based on meeting all requirements of the specification and receiving approval from UCPS 10 days prior to bid. A paragraph by paragraph comparison of the base bid specified system versus alternative systems with three references of similar projects (including project name, contact, phone number, location, consultant, value of contract and a brief description of the control system and how it operates) shall be submitted 15 days prior to bid for review process. The manufacture must have a working system in the school system for consideration.

2.2 Software

A. All field controllers must be fully programmable with windows based software with the following requirements:

1. Software must be windows 7 and 10 compatible

2. Software must not require hardware or software keys or licensing to operate

3. Software must not depend on any other software to operate

3. Connection to field controllers must be available via BACnet IP and Bluetooth

2.3 Sensors

All existing sensor and devices must be removed and walls and ducts must repaired and sealed properly

A. Temperature and humidity sensors as follows:

1. Space-Temperature Sensors: 10k type II Nickel Blank Stainless plate or Network sensor with no Set-point knob or Display.

2. Duct-Mounted or Immersion-Type Temperature Sensors: 10k type IINickel with Double encapsulated sensor and Easy open/close latch system (no screws)

3. Averaging-Element Sensors 10k type IINickel with copper averaging element and Easy open/close latch system (no screws)

4. Outdoors: Provide 10k type II Nickel sensor with 3% RH 0-10vdc transmitter with sun shield

5. Space and Duct Humidity Transmitters: 10k type II Nickel sensor with 3% RH 0-10vdc transmitter

6. Differential-Pressure Transmitters: Provide 0-10vdc transmitters with display

B. Equipment operation sensors as follows:

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg (0 to 1243 Pa).

2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psig (55 to 414 kPa).

3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

C. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled water applications, provide vapor proof type.

D. Room Thermostat Cover Construction: Manufacturer's standard locking covers to match existing.

E. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet (6 m).

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed

before proceeding with installation.

3.2 INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve sequence of operation specified.

D. Verify location of space temperature sensors, and other exposed control sensors with plans and room details before installation. Locate all 60 inches (1524 mm) above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

E. Install guards on thermostats in the following locations:

1. Entrances

2. Public areas

F. Install automatic dampers according to Division 15 Section "Duct Accessories."

G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components according to Division 15 Section

"Mechanical Identification."

I. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section

"Hydronic Piping."

J. Install duct volume-control dampers according to Division 15 Sections specifying air ducts

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."

B. Install building wire and cable according to Division 16 Section "Conductors and Cables."

C. Install signal and communication cable according to Division 16 Section "Control/Signal Transmission Media."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway.

3. Install concealed cable in raceway.

4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position but not to override manual or hard wired interlock controls.

3.4 FIELD QUALITY CONTROL

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Start, test, and adjust control systems.

2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.

3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

4. After test and calibration, any defective mechanical equipment must be reported in writing to UCPS project manager for repair before job signoff will be completed.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping,

Troubleshooting, servicing, and maintaining equipment and schedules.

2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs.

3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance

Data."

4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.6 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project

site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel

in making program changes and in adjusting sensors and controls to suit actual conditions.

3.7 JOB COMPLETION AND SIGNOFF

A. Job will be considered complete when all items of specifications are met and owner has satisfactorily completed in house commissioning

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig , and is reduced to secondary pressure of 0.5 psig or less.

D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator vent limiting device.
8. Maximum Inlet Pressure: 2 psig.

2.6 DIELECTRIC UNIONS

A. Minimum Operating-Pressure Rating: 150 psig.

B. Combination fitting of copper alloy and ferrous materials.

C. Insulating materials suitable for natural gas.

D. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

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.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.2 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

L. Verify final equipment locations for roughing-in.

M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

T. Do not use natural-gas piping as grounding electrode.

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install earthquake valves aboveground outside buildings according to listing.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches minimum; rod size, 3/8 inch
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within view of each gas-fired appliance and equipment (72" max). Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
6. Sealants and gaskets.
7. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.

d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

E. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. Hamlin Sheet Metal
g. Turn Key Duct Systems

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.

c. Knauf Insulation.
d. Owens Corning.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Aeroflex USA Inc.
b. Armacell LLC.
c. K-Flex USA.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.

4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. All medium pressure supply mains from built-up Air Handling Units to the terminal box connections.
      b. All concealed low pressure supply mains from built up Air Handing Units.
      c. Low pressure supply ducts (single zone units and supply ductwork downstream of terminal boxes): Test representative duct sections**,** totaling no less than 10 percent of total installed duct area for each designated pressure class.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Test for leaks before applying external insulation.
   5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel unless noted otherwise.

B. Supply Ducts:

1. Ducts Connected to Indoor Units, Packaged Heat Pumps, and Downstream of Terminal Boxes:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

C. Return Ducts:

1. Ducts Connected to Indoor Units and Packaged Heat Pumps:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 3-inch wg.
    b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 3-inch wg.
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Indoor Units or Packaged Heat Pumps:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum.

G. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch thick.
2. Return Air Ducts: 1 inch thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

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. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct security bars.
18. Duct accessory hardware.
19.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Source quality-control reports.

D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.
7. SEMCO Incorporated.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1500 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Maximum Leakage: 40” wide, 1% of max. flow.

F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.

G. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.

H. Blade Action: Parallel.

I. Blade Seals: Extruded vinyl, mechanically locked.

J. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

K. Tie Bars and Brackets: Aluminum.

L. Return Spring: Adjustable tension.

M. Bearings: Steel ball or synthetic pivot bushings.

N. Accessories: (as noted on plans or required by installation)

1. Electric actuators.
2. Chain pulls.
3. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20-gage minimum.
    b. Sleeve Length: 6 inches minimum.
4. Screen Mounting: Rear mounted.
5. Screen Material: Aluminum.
6. Screen Type: Bird or Insect (as noted on drawings)
7. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.
7. SEMCO Incorporated.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 1000 fpm..

D. Maximum System Pressure: 2-inch wg.

E. Maximum Leakage: 40” wide, 1% of max. flow.

F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.

G. Blades:

1. Multiple, 0.025-inch- thick, roll-formed aluminum.
2. Maximum Width: 2 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

H. Blade Seals: Vinyl.

I. Blade Axles: ½” diameter synthetic

J. Tie Bars and Brackets:

1. Material: Aluminum.
2. Rattle free with 90-degree stop.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic.

M. Accessories: (as noted on plans or required by installation)

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Flange on intake.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Ruskin Company.

2. Suitable for horizontal or vertical applications.
3. Frames:

a. Hat-shaped, galvanized-steel channels, 16-gauge minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 16-gauge thick.

5. Blade Axles: Galvanized steel.
6. Bearings:

a. Molded synthetic.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. METALAIRE, Inc.
4. Metal Form Manufacturing, Inc.
5. Nailor Industries Inc.
6. Ruskin Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches, airfoil design.
2. Opposed-blade design.
3. Galvanized steel.
4. 14-gauge thickness.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.

4. Pottorff; a division of PCI Industries, Inc.
5. NCA Manufacturing.
6. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 20-gauge galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

2.7 CEILING DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

2.8 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Blades: Roll-formed, horizontal, interlocking, 16-gauge thickness, galvanized sheet steel. Blades shall be true airfoil blades.

E. Leakage: Class I .

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: two-position action, electric 120V or 24V as noted on the plans.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

7. Electrical Connection: 120V or 24V as noted on the drawings.

J. Accessories: (as indicated on the drawings)

1. Auxiliary switches for or position indication.
2. Momentary test switch, damper mounted.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Modulating or two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 120V or 24V as noted on the drawings.

O. Accessories: (as indicated on the drawings)

1. Auxiliary switches for position indication.
2. Momentary test switch, damper mounted.

2.10 CORRIDOR DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-1/2-hour rating by an NRTL.

C. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

D. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

E. Frame: Multiple-blade type; fabricated with roll-formed, 16-gauge galvanized steel; with mitered and interlocking corners.

F. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: Modulating or two-position action.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 120V or 24V as noted on the drawings.

2.11 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel, 0.034 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative type with fill material.

a. Fill Material: Moisture-proof nonfibrous material.
b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar bag.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Lock form and seal or continuously weld joints.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Source Quality Control: Test according to ASTM E 477.

1. Testing in accordance with ASTM E-477.
2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

L. Capacities and Characteristics: As indicated on the drawings.

2.12 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 30 inches wide and double wall for larger dimensions.

2.13 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. Young Regulator Company.
4. Metropolitan.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 3/4 inches deep.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.14 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff; a division of PCI Industries, Inc.
7. Ruskin

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall, 12-gauge.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 2” to 10” for positive pressure and -4” to -10” for negative pressure.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.15 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.16 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

2.17 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing and manufacturer’s instructions.

H. Connect ducts to duct silencers with flexible duct connectors.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At drain pans and seals.
4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
6. Control devices requiring inspection.
7. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts directly or with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with approved strap and sealant.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

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. Bypass single-duct air terminal units
2. Dual-duct air terminal units.
3. Fan-powered air terminal units.
4. Induction air terminal units.
5. Shutoff single-duct air terminal units.
6. Integral-diffuser air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

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. Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Enviromental Technologies
2. Nailor Industries
3. Carrier
4. Price Industries
5. Trane
6. Titus
7. Krueger

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.6 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 BYPASS SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Diverting-damper assembly inside unit casing with control components located inside a protective metal shroud.

B. Casing: 22-gauge steel.

1. Casing Lining: 1/2-inch- thick, coated, fibrous-glass duct liner complying with NFPA 90A & UL 181; secured with adhesive.
2. Air Inlet: Round stub connection for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to diverter and other parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Diverter Assembly: Galvanized-steel gate, with polyethylene linear bearings.

D. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

E. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:

1. Primary and secondary overtemperature protection.
2. Nickel chrome 80/20 heating elements.
3. Airflow switch.
4. Noninterlocking disconnect switch.
5. Fuses (for coils more than 48 A).
6. Magnetic contactor for each step of control (for three-phase coils).

F. Electric Controls: Damper actuator and thermostat.

1. Damper Actuator: 24 V, powered closed, powered open with microswitch to energize heating control circuit.
2. Thermostat: Wall-mounting electric type with temperature display in Fahrenheit and Celsius, and space temperature set point.
3. Changeover Thermostat: Duct-mounting, electric type reverses action of controls when duct temperature rises 70 deg F.

G. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat.

1. Damper Actuator: 24 V, powered closed, powered open.
2. Thermostat: Wall-mounting electronic type with the following features:

a. Proportional, plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Temperature set-point display in Fahrenheit and Celsius.
d. Auxiliary switch shall energize heating control circuit.
e. Changeover thermistor shall reverse action.

2.2 FAN-POWERED AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly and fan in series or in parallel arrangement, as indicated on Drawings, inside unit casing with control components inside a protective metal shroud.

B. Casing: 22-gauge steel..

1. Casing Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.

D. Fan Section: Galvanized-steel plenum, with direct-drive, forward-curved fan with air filter and backdraft damper.

1. Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
b. Fan-Motor Assembly Isolation: Rubber isolators.

2. Air Filter: 1-inch- thick, fiberglass throwaway, MERV 6 according to ASHRAE 52.2.

E. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

F. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:

1. Primary and secondary overtemperature protection.
2. Nickel chrome 80/20 heating elements.
3. Fan interlock contacts.
4. Noninterlocking disconnect switch.
5. Fuses (for coils more than 48 A).
6. Magnetic contactor for each step of control (for three-phase coils).

G. Factory-Mounted and -Wired Controls: Electrical components shall be mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
3. Disconnect Switch: Factory-mounted, fused type.

H. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

I. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section " Instrumentation and Control for HVAC."

1. DDC controls shall be furnished by the controls vendor and shipped to the terminal unit manufacturer for factory mounting.

2. DDC controller shall be supplied by the BAS contractor to be factory mounted by the terminal box manufacturer.

J. Control Sequence: See Sequence of Operation.

2.3 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

B. Casing: 22-gauge steel.

1. Casing Lining: 1/2-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.

1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.

E. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

F. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:

1. Primary and secondary overtemperature protection.
2. Nickel chrome 80/20 heating elements.
3. Airflow switch.
4. Noninterlocking disconnect switch.
5. Fuses (for coils more than 48 A).
6. Magnetic contactor for each step of control (for three-phase coils).

G. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation and Control for HVAC."

1. DDC controls shall be furnished by the controls vendor and shipped to the terminal unit manufacturer for factory mounting.

H. DDC Controls: Bidirectional damper operators and microprocessor-based controller and room sensor shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:

1. Damper Actuator: 24 V, powered closed, spring return open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

a. Proportional, plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Occupied and unoccupied operating mode.
d. Remote reset of airflow or temperature set points.
e. Adjusting and monitoring with portable terminal.
f. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

3. Room Sensor: Wall mounting, with temperature set-point adjustment and access for connection of portable operator terminal.

4. DDC controller shall be supplied by the BAS contractor to be factory mounted by the terminal box manufacturer.

I. Control Sequence: See Sequence of Operation.

2.4 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. 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.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and do the following:

a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
b. Verify that controls and control enclosure are accessible.
c. Verify that control connections are complete.
d. Verify that nameplate and identification tag are visible.
e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233600

A. FENCING (Section 02830)

1. General

a. Related Documents

b. Summary

l) Extent of chain link fences and gates is indicated on drawings.

2) Chain link fencing heights and gate widths shall be as noted on the drawings.

c. Quality Assurance

1) Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

d. Submittals

1) Submit manufacturers' technical data and installation instructions for metal fencing, fabric, gates, and accessories.

2. Products

a. General

I) Dimensions indicated for form pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

2) Available manufacturers: Manufacturers offering products which may be incorporated in the work include, for galvanized steel fencing and fabric:

- Allied Tube and Conduit Corp.
- American Fence Corp.
- Anchor Fence, Inc. - or approved equal.

b. Steel Fabric:

1) Fabric: No. 9 gauge (0.148" + 0.005") size steel wires, 2" mesh, with top selvages 60" high unless noted otherwise on drawings..

- Fabric Finish: Galvanized, ASTM A 392, Class 11, with not less than 2.0 oz. zinc per sq. ft. of surface.

- PVC Coating Color: As selected by Owner's representative, Architect, or Landscape Architect from manufacturers' standard complying with ASTM F 934.

c. Framing:

1) Posts and other appurtenances used in the construction of chain link fences shall be either "Type I" or "Type Il" round posts as specified below.

i. Type "I" round posts shall be hot dipped galvanized, conforming with ASTM Al 20 standard weight (Schedule 40), except the hydrostatic testing requirement is waived. Zinc coating shall not be less than .8 ounces per sq. ft.

ii. Type "11" round posts shall be manufactured from steel conforming to ASTM A569 having a minimum yield strength of 50,000 psi. Type Il posts shall have an exterior triple coating consisting of the following:

„Zinc—I .0 plus or minus 0.1 ounce per square foot.

Chromate—30 plus or minus 15 micrograms.

Clear polymer coating—O.5 plus or minus 0.2 mils.

iii. Post sizes and weights specified herein refer to Type I materials. Equivalent sizes and weights of Type Il materials are acceptable.

2) The intermediate posts shall be 2.375 inches o.d. pipe nominal weight 3.65 lbs. per lineal foot.

3) End, corner, and pull posts shall be 2.875 inches o.d. pipe, nominal weight 5.79 lbs. per lineal foot.

4) Posts for swing gates shall be standard weight pipe of the following nominal sizes and weights for each gate leaf:

i. Gate leaf up to 6 feet wide: 2-7/8 inches o/d. wt. 5.79 lbs. PLF. ii. Gate leaf over 6 to 13 feet wide: 4 inches o/d. wt. 9.1 lbs. PLF.

111. Gate leaf over 13 to 18 feet wide: 6-5/8 inches o/d. wt. 18.97 lbs. PLF.

IV. Gate leaf over 18 feet wide: 8-5/8 inches o/d. wt. 24.70 lbs. PLE

NOTE: Gate posts shall be equipped with tops so designed to exclude moisture from the post.

5) Supplemental Color Coating: In addition to above metallic coatings, provide posts and rails with manufacturer's standard polymer coating according to ASTM F 1234, 10 mil minimum polyvinyl chloride (PVC) or 3 mil minimum polyester plastic resin finish applied to exterior surfaces and, except for tubular shapes, to exposed interior surfaces. Color to match chain link fabric as selected.

d. Accessories:

I) Fittings and accessories: galvanized, ASTM A 153, with zinc weights per Table I.

2) Top rail: manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull, and end post.

i. 1.66" OD pipe, 2.27 lbs. per foot or 1.625"x1.25" rollformed sections, 1.35 lbs. per ft.

3) Wire ties: I gauge galvanized steel or 11 gauge aluminum wire, to match fabric core material.

4) Post brace assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of comer and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and fi-uss to line posts with 0.375"

diameter rod and adjustable tightener.

5) Post tops: Provide weather-tight closure cap with loop to receive top-rail; one cap for each post.

6) Sü•etcher bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16"x3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

7) Stretcher bar bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

e. Gates:

1) Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation an attachment of fabric, hardware, and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

i. Provide same fabric as for fence, otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.

ii. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

2) Swing gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

3) Gate hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

i. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180^0 gate opening. Provide 1-1/2 pair o

f llülges for each leaf over 6' nominal height.

ii. Double gates: Provide double fulcrum latches welded to gate post.

iii. Single gates: Provide regular fulcrum latch welded to gate post.

4) Horizontal Slide Gate Posts: Provide steel pipe gate posts sized as follows, according to ASTM F 1184, for Type Il, cantilever slide gates:

i. Opening width over 12 feet: 4.000 inch OD pipe weighing not less than 6.56 lb. per ft.

5) Concrete: Provide concrete consisting of Portland cement, ASTM C 150, aggregates, ASTM C 33 and lean water. Mix materials to obtain concrete with a rninimum 28 day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., l" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

f. Privacy Slats:

1) Material: Polyethylene tubular slats, 0.023 inch thick minimum, manufactured for chain link fencing from virgin polyethylene containing an ultraviolet inhibitor, sized to fit mesh specified in direction indicated. Provide 75 to 85 percent privacy factor. Provide on gates at entry to service courts.

i. Material: Aluminum 0.010 inch thick rninimum, sized to fit mesh specified in direction indicated.

ii. Color: Selected by Architect from manufacturer's standard colors.

iii. Provide at service court gates.

3. Installation

A. Installation:

I) Do not begin installation and erection before final grading is completed, unless otherwise permitted.

2) Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings shown in form, undisü-ibuted, or compacted soil.

   i. Excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not fess than 4 times largest cross-section of post.

   ii. Excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

3) Setting Posts: Center and align in holes 3" above bottom of excavation.

   i. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

   ii. Unless otherwise indicated, extend concrete footings 2" above gade and trowel to a crown to shed water.

4) Top rails: Run rail continuously through post caps.

5) Brace assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

6) Fabric: Leave approximately 2" between finish grade and bottom selvage, otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires.

7) Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.

8) Stretcher bars: Thread through or clamp to fabric 4" o.c., and secure posts with metaf bands spaced 15" o.c.

9) Gates: Install gates plumb, level, and secure for full opening without interference. Install

ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

10) Tie wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

i. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.

11) Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

2018 NORTH CAROLINA ENERGY CONSERVATION CODE

COMMERCIAL ENERGY EFFICIENCY – ELECTRICAL SUMMARY

C401 METHOD OF COMPLIANCE

- ☐ 2018 NCECC CHAPTER 4
- ☐ NC SPECIFIC COMCHECK PROVIDED
- ■ N/A BASED ON PROJECT SCOPE
- ☐ ASHRAE 90.1–2013

C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

- ☐ C406.2 EFFICIENT MECH EQUIPMENT
- ☐ C406.5 ON–SITE RENEWABLE ENERGY
- ☐ C406.3 REDUCED LTG DENSITY
- ☐ C406.6 DEDICATED OA SYSTEM
- ☐ C406.4 ENHANCED DIGITAL LTG CNTLS
- ☐ C406.7 HI–EFF SERVICE WTR HTG
- ■ NOT APPLICABLE BASED ON PROJECT SCOPE
- ☐ C406.7.1 WTR HTG LOAD FRACTION

C408 – SYSTEM COMMISSIONING:

- ☐ BUILDING IS LESS THAN 10,000 SQUARE FEET AND IS EXEMPT FROM THE SYSTEM COMMISSIONING REQUIREMENTS OF SECTION C408.
- ☐ BUILDING IS GREATER THAN 10,000 SQUARE FEET AND REQUIRES SYSTEM COMMISSIONING PER SECTION C408.
- ■ NOT APPLICABLE

C405.2 – LIGHTING CONTROLS (MANDATORY REQUIREMENTS):

- ☐ LIGHTING SYSTEMS ARE PROVIDED WITH CONTROLS AS REQUIRED PER SECTION C405.2, EXCEPT WHERE EXEMPT.
- ■ NOT APPLICABLE

C405.3 – EXIT SIGNS (MANDATORY REQUIREMENTS):

- ☐ INTERNALLY ILLUMINATED EXIT SIGNS DO NOT EXCEED 5 WATTS PER SIDE.
- ■ NOT APPLICABLE

C405.4 – INTERIOR LIGHTING POWER REQUIREMENTS (PRESCRIPTIVE) (NON–EXEMPT):

- ■ NOT APPLICABLE PER 2018 NCECC C503.1, EXCEPTION 2.G.

C405.4.1 – TOTAL CONNECTED INTERIOR LIGHTING POWER:

_____ WATTS SPECIFIED
_____ % REDUCTION OF SPECIFIED VS. ALLOWED (APPLICABLE IF C406.1.2 IS SELECTED)

C405.4.2 – TOTAL ALLOWABLE INTERIOR LIGHTING POWER:

METHOD OF COMPLIANCE:

- ☐ BUILDING AREA METHOD
- ☐ SPACE–BY–SPACE METHOD

_____ WATTS ALLOWED

C405.5.1 – EXTERIOR BUILDING LIGHTING POWER (NON–EXEMPT):

- ■ NOT APPLICABLE

TOTAL CONNECTED EXTERIOR LIGHTING POWER:

_____ WATTS SPECIFIED

TOTAL ALLOWABLE EXTERIOR LIGHTING POWER:

_____ WATTS ALLOWED

C405.6 – ELECTRICAL ENERGY CONSUMPTION (DWELLING UNITS):

- ☐ SEPARATE ELECTRICAL METERING HAS BEEN PROVIDED FOR EACH DWELLING UNIT IN GROUP R–2 BUILDINGS.
- ■ NOT APPLICABLE

C405.7 – ELECTRICAL TRANSFORMERS (MANDATORY REQUIREMENTS):

- ☐ ELECTRICAL TRANSFORMERS HAVE BEEN SPECIFIED TO MEET MINIMUM EFFICIENCY REQUIREMENTS PER C405.7, EXCEPT WHERE EXEMPT.
- ■ NOT APPLICABLE

C405.8 – ELECTRICAL MOTORS (MANDATORY REQUIREMENTS):

- ☐ ELECTRICAL MOTORS HAVE BEEN SPECIFIED TO MEET MINIMUM EFFICIENCY REQUIREMENTS PER C405.8, EXCEPT WHERE EXEMPT.
- ☐ NOT APPLICABLE

C405.9 – VERTICAL AND HORIZONTAL TRANSPORTATION SYSTEMS AND EQUIPMENT:

- ☐ VERTICAL AND HORIZONTAL TRANSPORTATION SYSTEMS AND EQUIPMENT HAVE BEEN SPECIFIED TO COMPLY WITH REQUIREMENTS PER C405.9, EXCEPT WHERE EXEMPT.
- ■ NOT APPLICABLE

SYMBOL SCHEDULE

DEVICES AND PATHWAYS

- BRANCH CIRCUIT HOMERUN TO PANEL.
- GFCI — GROUND FAULT RECEPTACLE. NEMA 5–20R DUPLEX.
- WP — WEATHERPROOF RECEPTACLE.
- CO — CARBON MONOXIDE DETECTOR.
- DT — DUCT DETECTOR/SENSOR.
- OCDT — CEILING MOUNTED OCCUPANCY SENSOR, DUAL TECHNOLOGY.
- PP — CEILING MOUNTED OCCUPANCY SENSOR POWER PACK.

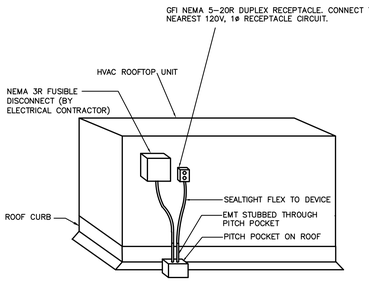
PANELS, DISCONNECTS

- FUSED HEAVY DUTY DISCONNECT SWITCH. NUMERALS INDICATE SWITCH RATING/FUSE SIZE. NEMA 1 ENCLOSURE, UNLESS OTHERWISE NOTED.
- PANELBOARD. SEE SCHEDULE FOR MOUNTING.
- FACP — FIRE ALARM CONTROL PANEL.

ELECTRICAL SHEET INDEX

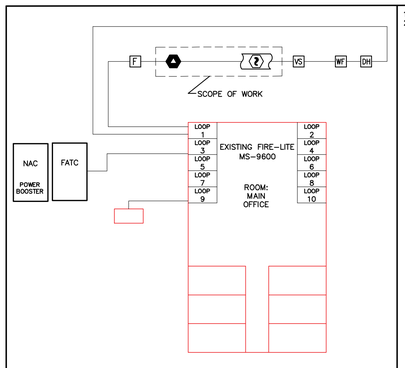
PROJECT SUMMARY

5 RTU REPLACEMENTS. 1 AHU REPLACEMENT. RTU–5 & RTU–6 ARE INCREASING IN SIZE. OTHERS ARE THE SAME OR DECREASING IN SIZE. CEILING WORK IN CLASSROOMS 5A & 6A.



NOTE: TYPICAL FOR ALL ROOF MOUNTED HVAC EQUIPMENT.

2 ROOFTOP RECEPTACLE DETAIL — NO SCALE



1. FACP IS EXISTING.
2. THE CIRCUIT FEEDING THE FIRE ALARM IS FOR THE ALARM ONLY

1 FIRE ALARM RISER DIAGRAM — NO SCALE

GENERAL PROJECT NOTES

A. ELECTRICAL CODE COMPLIANCE SHALL BE IN ACCORDANCE WITH NEC 2020.
B. ALL ELECTRICAL MATERIALS, DEVICES, APPLIANCES, AND EQUIPMENT SHALL BE LABEL LISTED BY AN NC APPROVED THIRD PARTY TESTING AGENCY.
C. FIRE ALARM SHOP DRAWINGS SHALL BE INSTALLED PER NFPA 72 2013 REQUIREMENTS.

1. GENERAL:

A. THE WORK COVERED BY THESE SPECIFICATIONS CONSISTS OF FURNISHING ALL LABOR, EQUIPMENT, MATERIALS AND SUPPLIES AS NECESSARY FOR THE COMPLETE AND SATISFACTORY OPERATING ELECTRICAL SYSTEMS AS SHOWN ON THE PLANS.
B. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2020 NATIONAL ELECTRICAL CODE, NFPA, STATE BUILDING CODE, AND ANY OTHER LOCAL REQUIREMENTS THAT MAY APPLY.
C. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL ELECTRICAL PERMITS AND INSPECTION FEES.
D. ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND SHALL BE LISTED BY THE UNDERWRITER'S LABORATORIES, INC. OR BY A STATE APPROVED THIRD PARTY TESTING AGENCY FOR THE USE INTENDED WHERE A STANDARD FOR SUCH MATERIALS AND USE EXISTS. ALL ITEMS OF THE SAME TYPE AND RATING SHALL BE IDENTICAL AND OF THE SAME MANUFACTURER.
E. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND CATALOG DATA IN ELECTRONIC FORMAT (PDF) FOR ALL ELECTRICAL ITEMS IN THE SCOPE OF WORK, INCLUDING, BUT NOT LIMITED TO, RACEWAYS, BOXES, FITTINGS, CONDUCTORS, LUMINAIRES, LAMPS, BALLASTS, WIRING DEVICES, SAFETY SWITCHES, DISCONNECTS, TRANSFORMERS, PANELBOARDS, FIRE ALARM, TELECOMMUNICATIONS, ETC. FOR APPROVAL AS APPLICABLE FOR THE PROJECT. ONE COMPLETE SET OF APPROVED SUBMITTALS SHALL BE MAINTAINED AT THE JOB SITE.
F. ALL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT TO COMPLY WITH THE BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, CONDUIT, WIRING, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, METHODS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COSTS ASSOCIATED WITH SUBSTITUTED EQUIPMENT WILL BE APPROVED AFTER BIDS HAVE BEEN ACCEPTED AND ALL COSTS WILL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR. CREDITS SHALL BE GIVEN TO THE OWNER WHERE SUCH EQUIPMENT AND METHODS RESULT IN LESS EXPENSE TO THE CONTRACTOR.
G. ONE COMPLETE SET OF THE LATEST CONSTRUCTION PLANS OF ALL TRADES SHALL BE MAINTAINED AT THE JOB SITE. IN ADDITION, ALL ADDENDUMS, BULLETINS, AND/OR SKETCHES SHALL BE INCORPORATED INTO THE ON–SITE CONSTRUCTION PLANS AS THE JOB PROGRESSES.
H. COMPLETELY ADEQUATE HOUSING SHALL BE PROVIDED FOR ALL MATERIALS STORED ON JOB SITE. ONLY CONDUIT MAY BE STORED OUTSIDE, BUT NOT IN CONTACT WITH THE GROUND.
I. THE CONDUIT AND NEUTRAL SYSTEM SHALL BE GROUNDED AT THE MAIN SERVICE EQUIPMENT. GROUNDING ELECTRODE SYSTEM SHALL BE INSTALLED PER NEC 250.
J. PROVIDE AN INTERSYSTEM BONDING TERMINATION DEVICE AT THE MAIN ELECTRICAL SERVICE PER NEC 250.94.
K. WIRING SHALL BE TESTED FOR CONTINUITY AND GROUNDS BEFORE BEING ENERGIZED. FAULTY WIRING SHALL BE REPLACED AT NO ADDITIONAL EXPENSE TO THE OWNER.
L. PROVIDE ALL CUTTING AND PATCHING FOR INSTALLATION OF WORK AND REPAIR ANY DAMAGE DONE.
M. THE ELECTRICAL CONTRACTOR SHALL CONNECT ALL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS (UNLESS OTHERWISE NOTED), EXCEPT FOR CONTROL WIRING FOR EQUIPMENT NOT PROVIDED BY THE ELECTRICAL CONTRACTOR. CONTROL WIRING FOR SUCH EQUIPMENT SHALL BE PROVIDED BY THE RESPECTIVE DISCIPLINE.
N. ALL ELECTRICAL JUNCTION BOXES, SWITCHGEAR, CABLING, VOICE/DATA OUTLETS, LOW VOLTAGE CABINETS, EMERGENCY RECEPTACLES, ETC. SHALL BE LABELED ACCORDING TO PANEL/RACK AND CIRCUIT NUMBER.
O. UPON COMPLETION OF WORK, CONTRACTOR SHALL PRESENT ENGINEER WITH CERTIFICATE OF APPROVAL FROM LOCAL INSPECTOR AND/OR AUTHORITY HAVING JURISDICTION BEFORE WORK WILL BE APPROVED FOR FINAL PAYMENT.
P. CONTRACTOR SHALL GUARANTEE ALL WORK AND MATERIALS FOR A PERIOD OF ONE YEAR EFFECTIVE THE DATE THE PROJECT IS ACCEPTED BY THE OWNER. ANY IMPERFECT MATERIALS OR WORKMANSHIP SHALL BE REPLACED WITHOUT ADDED COST TO THE PROJECT.
Q. IT SHALL NOT BE THE INTENT OF ISSUED PLANS AND/OR SPECIFICATIONS TO SHOW EVERY MINOR DETAIL OF CONSTRUCTION. THE ELECTRICAL CONTRACTOR IS EXPECTED TO FURNISH AND INSTALL ALL NECESSARY ITEMS FOR A COMPLETE AND OPERATING SYSTEM.
R. THE WORD "PROVIDE" MEANS THAT THIS CONTRACTOR SHALL FURNISH, FABRICATE, ERECT, CONNECT, AND COMPLETELY INSTALL SYSTEMS IN PROPER OPERATING CONDITION. ALL LABOR, PRODUCT OPTIONS, ACCESSORIES AND INCIDENTAL MATERIALS REQUIRED SHALL BE INCLUDED AS PART OF THIS WORK TO COMPLETE THE INSTALLATION.
S. THE WORD "CONNECT" MEANS THAT THIS CONTRACTOR SHALL PROVIDE (SEE DEFINITION ABOVE) ALL DISCONNECTING MEANS, OVERCURRENT PROTECTION AND WIRING REQUIRED TO PLACE THE EQUIPMENT AND SYSTEMS IN PROPER OPERATING CONDITION AND TO COMPLY WITH CODE REQUIREMENTS.
T. CONTRACTOR SHALL COORDINATE THE ROUGH–IN OF ALL OUTLET LOCATIONS WITH ARCHITECTURAL FLOOR PLANS, ELEVATIONS, AND MILLWORK SHOP DRAWINGS PRIOR TO ROUGH–IN.
U. ELECTRICAL CONTRACTOR SHALL NOT SCALE PLANS. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR EXACT LOCATIONS OF ALL EQUIPMENT, UNLESS OTHERWISE NOTED.
V. IF DURING THE COURSE OF WORK, THE CONTRACTOR DISCOVERS A PROBLEM WITH THE PERFORMANCE OF THE INSTALLATION RELATIVE TO THE PLANS AND SPECIFICATIONS, THE NEC, OR OTHER CODES OR REQUIREMENTS, THE CONTRACTOR SHALL IMMEDIATELY BRING THE PROBLEM TO THE ATTENTION OF THE ARCHITECT AND/OR ENGINEER FOR RESOLUTION PRIOR TO THE EXECUTION OF THE WORK.
W. WHERE THERE ARE CONFLICTS BETWEEN THE PLANS AND SPECIFICATIONS, THE CONTRACTOR SHALL BRING THE ISSUE TO THE ATTENTION OF THE ENGINEER FOR RESOLUTION PRIOR TO THE EXECUTION OF THE WORK OR ORDERING ANY MATERIALS. NO ADDITIONAL COSTS SHALL BE WARRANTED WITHOUT A CHANGE TO THE PROJECT SCOPE.

2. RACEWAY:

A. CONDUIT SHALL BE MANUFACTURED BY ALLIED, WHEATLAND, REPUBLIC CONDUIT, WESTERN TUBE, OR APPROVED EQUIVALENT.
B. FOR INTERIOR WORK, CONDUIT SHALL BE ZINC COATED EMT EXCEPT WHERE NOT PERMITTED BY CODE. USE SCHEDULE 40 PVC BELOW CONCRETE SLAB, IN DUCTBANKS, AND FOR EXTERIOR WORK WHERE NOT SUBJECT TO DAMAGE. USE IMC WHERE SUBJECT TO PHYSICAL DAMAGE.
C. EMT FITTINGS SHALL BE COMPRESSION GLAND TYPE, OF MALLEABLE STEEL. CONNECTORS SHALL HAVE INSULATED THROATS. CAST, SET SCREW, OR INDENTER TYPE FITTINGS ARE NOT ACCEPTABLE. ALL FITTINGS FOR EMT SHALL BE MADE OF STEEL.
D. ALL RACEWAY SHALL BE RUN CONCEALED, UNLESS OTHERWISE NOTED. FISH ALL NEW OUTLETS IN EXISTING WALLS, WHERE POSSIBLE. ALL RUNS SHALL BE NEAT AND SQUARE.
E. LOW VOLTAGE CABLING NOT SPECIFIED TO BE INSTALLED IN CONDUIT, SHALL BE INSTALLED IN A CABLE TRAY SYSTEM OR J–HOOK SYSTEM CONSISTING OF MINIMUM 2" DIAMETER HOOKS LOCATED ON 3'–0" CENTERS IN ALL ACCESSIBLE CEILINGS. WHERE THERE ARE INACCESSIBLE CEILINGS, PROVIDE CONDUIT FOR ENTIRE LENGTH OF INACCESSIBILITY.
F. RACEWAYS USED FOR LOW VOLTAGE SYSTEMS SUCH AS TELECOMMUNICATIONS, FIRE ALARM, SECURITY, CCTV, CONTROLS, AND SIMILAR CONDUITS ABOVE THE CEILING AND BACKBOARD(S) SHALL BE PROVIDED WITH INSULATED THROAT BUSHINGS AT EACH CONDUIT TERMINATION. THESE BUSHINGS SHALL BE BE INSTALLED PRIOR TO PULLING LOW–VOLTAGE CABLES.
G. RACEWAY PENETRATIONS THROUGH FLOOR SLABS AND FIRE–RATED WALLS SHALL BE FILLED WITH IMPERVIOUS, NON–SHRINK GROUT SUFFICIENTLY TIGHT TO PREVENT THE TRANSFER OF SMOKE, WATER, AND DUST. ROOF PENETRATIONS SHALL BE WITHIN THE EQUIPMENT ROOF CURB.
H. SUPPORT ALL CONDUIT WITH STRAPS AND CLAMPS.
I. ALL CONDUIT SHALL BE RUN PARALLEL OR PERPENDICULAR TO BUILDING LINES, WHETHER EXPOSED OR NOT AND SUPPORTED FROM STRUCTURE AND PROPERLY SECURED.
J. WHERE CONDUITS PASS THROUGH A BUILDING EXPANSION JOINT, PROVIDE GALVANIZED EXPANSION FITTINGS WITH BONDING JUMPERS.
K. MINIMUM CONDUIT SIZE SHALL BE 3/4" FOR INTERIOR WORK, 1" FOR EXTERIOR WORK.
L. PROVIDE MINIMUM 210# TEST NYLON PULL CORD AND NYLON BUSHINGS IN ALL EMPTY RACEWAYS.
M. LIQUID–TIGHT METAL CONDUIT SHALL ONLY BE USED FOR FINAL CONNECTIONS TO EQUIPMENT AND ALL OTHER ROTATING AND VIBRATING EQUIPMENT, MAXIMUM LENGTH OF 3'–0".
N. PROVIDE PULL BOXES, SUCH THAT NO SINGLE CONDUIT RUN HAS BENDS IN EXCESS OF 360°. PULL BOXES SHALL BE SUITABLE AND APPROVED FOR THE INTENDED USE. WHERE CONDUITS PASS UNDER PAVED AREAS, THEY SHALL BE RGS.
O. ALL CONDUIT BENDS/ELBOWS EMERGING FROM UNDERGROUND SHALL BE IMC AND SHALL EXTEND A MINIMUM OF 18" BELOW GRADE.
P. THE USE OF AC OR NM CABLE IS NOT PERMITTED.

3. OUTLET BOXES:

A. JUNCTION AND PULL BOXES SHALL BE CODE GAUGE GALVANIZED STEEL. ACCEPTED MANUFACTURERS SHALL BE STEEL CITY (THOMAS & BETTS), RACO, CROUSE–HINDS, APPLETON (EMERSON), OR APPROVED EQUIVALENT.
B. OUTLET BOXES SHALL NOT BE MOUNTED BACK TO BACK IN COMMON WALLS.
C. ATTACH EMT WITH CONNECTORS HAVING INSULATED THROAT.
D. ATTACH BOXES TO STUD WORK USING CADDY BAR STRAPS THAT CONNECT TO TWO ADJACENT METAL STUDS TO PREVENT TWISTING OF BOX IN WALL.
E. ALL OUTLET BOXES (INCLUDING TELEPHONE, CABLE TV, AND COMPUTER) SHALL HAVE COVER PLATES, BLANK IF NOT USED.
F. ALL EXTERIOR BOXES SHALL BE WATER–TIGHT.

4. CONDUCTORS:

A. CONDUCTORS SHALL BE MANUFACTURED BY SOUTHWIRE (SIMPULL), ENCORE (SUPERSLICK), UNITED COPPER (SLK), CERRO (SLP), OR APPROVED EQUAL, "PRE–LUBRICATED" BY THE MANUFACTURER.
B. ALL CONDUCTORS SHALL BE COPPER, RATED 75° C WET/DRY EXCEPT WHERE OTHERWISE NOTED OR REQUIRED BY U.L. OR OTHER CODES
C. ALL CONDUCTORS SHALL BE SINGLE INSULATED CONDUCTOR, THHN/THWN–2. SIZES #10 AWG AND SMALLER SHALL BE SOLID, SIZES #8 AWG AND LARGER SHALL BE STRANDED.
D. BRANCH CIRCUITS SHALL NOT BE SMALLER THAN #12 AWG. CONTROL WIRING MAY BE #14 AWG.
E. CONDUCTORS SHALL BE COLOR CODED BLACK/RED/BLUE FOR 120/208 VOLT SYSTEMS AND BROWN/ORANGE/YELLOW FOR 277/480 VOLT SYSTEMS FOR A, B, AND C PHASES, RESPECTIVELY. NEUTRAL SHALL BE WHITE FOR 120/208 VOLT SYSTEMS AND NATURAL GRAY FOR 277/480 VOLT SYSTEMS. GROUND CONDUCTOR SHALL BE GREEN ON ALL SYSTEMS. ALL CONDUCTOR SIZES SHALL HAVE COLOR–CODED INSULATION. THE USE OF COLORED TAPE ON LARGER WIRE SIZES SHALL NOT BE ALLOWED.
F. INSULATION SHALL BE DUAL RATED TYPE THHN/THWN–2 FOR FEEDERS AND BRANCH CIRCUITS. FIXTURE TAPS SHALL BE #12 THHN/THWN–2 IN FLEX WITH GREEN #12 AWG GROUNDING CONDUCTOR.
G. ALL CONDUCTORS SHALL BE IN CONDUIT.
H. WIRING TO LIGHTING FIXTURES SHALL BE AS REQUIRED BY UL LABEL.
I. MULTI–WIRE BRANCH CIRCUITS SHALL NOT BE ALLOWED.
J. JOINTS IN #10 AWG AND SMALLER SHALL BE MADE UP WITH CRIMPED CONNECTORS WITH INSULATING CAPS (NO TAPE) OR WIRENUTS (MAXIMUM OF 3 CONDUCTORS UNDER ANY CONNECTOR OR WIRENUT). LARGER WIRE SHALL USE SPLIT BOLTS OR BOLTED CLAMPS.
K. ALL WIRING LUGS THROUGHOUT THE PROJECT, INCLUDING, BUT NOT LIMITED TO, BREAKERS, PANELBOARD/SWITCHBOARD LUGS, SAFETY SWITCH LUGS, MOTOR STARTER LUGS, TRANSFORMERS LUGS, WIRING DEVICE TERMINALS, AND ALL EQUIPMENT LUGS/TERMINALS SHALL BE RATED FOR USE WITH 75 DEGREE INSULATED CONDUCTORS AT THEIR 75 DEGREE AMPACITY AND SHALL BE SIZED AND SELECTED TO MATCH THE CONDUCTOR SIZE AND MATERIAL.
L. CIRCUIT JOINTS SHALL NOT BE MADE ON DEVICE TERMINALS.
M. WIRE WITHIN PANELBOARDS SHALL BE NEATLY TRAINED, SQUARED, BUNCHED, AND TAGGED.
N. ALL SYSTEM FURNITURE CONNECTIONS SHALL COMPLY WITH NEC 605.
O. GROUND ALL EQUIPMENT PER NEC ARTICLE 250. BOND WHERE CONDUITS ENTER ENCLOSURES THROUGH CONCENTRIC KNOCKOUTS. ALL FLEX, INCLUDING FIXTURE TAPS, SHALL INCLUDE GREEN GROUNDING CONDUCTOR, #12 AWG MINIMUM. PROVIDE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR IN EACH CONDUIT AND FOR EACH CIRCUIT, SIZED PER NEC 250–122.
P. ALL CONDUCTORS INSTALLED IN VERTICAL RACEWAYS SHALL BE SUPPORTED AT INTERVALS AS REQUIRED PER NEC 300–19.
Q. THE ELECTRICAL CONTRACTOR SHALL FOLLOW AND APPLY THE TABLE BELOW, REGARDLESS WHAT THE PANEL SCHEDULE INDICATES, FOR SIZING ALL 120V & 277V, 20 AMP BRANCH CIRCUITS (COPPER CONDUCTORS) TO ALLOW A MAXIMUM OF 3% VOLTAGE DROP FROM THE CIRCUIT BREAKER TO THE FIRST DEVICE ON THE BRANCH CIRCUIT AND ACHIEVE A MAXIMUM OF 5% VOLTAGE DROP ACROSS THE ENTIRE BRANCH CIRCUIT:

VOLTAGE	CONDUCTOR LENGTH *	BRANCH CIRCUIT
120	0' – 50'	#12
120	51' – 90'	#10
120	91' – 140'	#8
120	141' – 225'	#6
277	0' – 125'	#12
277	126' – 200'	#10
277	201' – 330'	#8
277	331' – 525'	#6

* – THE LENGTH IS MEASURED FROM THE CIRCUIT BREAKER TO THE FIRST DEVICE WHICH THE BRANCH CIRCUIT SERVES. WHERE THE DISTANCE EXCEEDS ABOVE, CONSULT WITH THE ENGINEER.

5. SUPPORTS:

A. ALL EQUIPMENT SHALL BE ADEQUATELY SUPPORTED FROM STRUCTURE.
B. INSERTS IN MASONRY SHALL BE LEAD OR FIBER IN DRILLED HOLES, OR CAST IN PLACE.
C. NAILS OR POWDER ACTUATED FASTENERS SHALL NOT BE USED.
D. EMT/IMC/RGS SUPPORTS SHALL BE A MAXIMUM OF 8'–0" APART AND A MAXIMUM OF 3'–0" FROM BOXES.

6. SEISMIC:

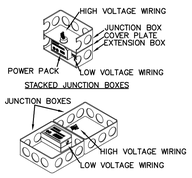
A. THE ELECTRICAL CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR PROVIDING SEISMIC SUPPORT AND BRACING OF ELECTRICAL COMPONENTS TO RESIST THE EFFECTS OF EARTHQUAKES ON THE ELECTRICAL SYSTEM AS WELL AS ANY REQUIRED SPECIAL INSPECTIONS BASED ON THE SPECIFIC GEOGRAPHIC LOCATION AS REQUIRED. THE SEISMIC RESTRAINTS AND SPECIAL INSPECTIONS SHALL MEET ALL APPLICABLE STATE AND LOCAL BUILDING CODE REQUIREMENTS AS WELL AS ASCE–7 REQUIREMENTS.

7. ELECTRICAL COORDINATION WITH OTHER TRADES:

A. THE ELECTRICAL CONTRACTOR SHALL CONNECT AND/OR PROVIDE FINAL CONNECTIONS TO ALL EQUIPMENT SUPPLIED BY OTHERS APPLICABLE TO THE PROJECT, INCLUDING BUT NOT LIMITED TO, MECHANICAL, PLUMBING, FIRE PROTECTION AND SUPPRESSION, OWNER FURNISHED, KITCHEN, LABORATORY, ETC. UNLESS OTHERWISE NOTED.
B. THE ELECTRICAL CONTRACTOR SHALL COORDINATE ALL CONNECTIONS PRIOR TO ROUGH–IN USING APPROVED CATALOG SHEETS AND SHOP DRAWINGS.
C. THE ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL ALL MANUAL MOTOR STARTER SWITCHES, DISCONNECT SWITCHES, RECEPTACLES, ETC. TO MECHANICAL AND PLUMBING EQUIPMENT. ALL STARTERS, OTHER THAN MANUAL STARTER SWITCHES, SHALL BE PROVIDED BY OTHERS, BUT INSTALLED BY THE ELECTRICAL CONTRACTOR.
D. ALL DISCONNECT SWITCHES AND FUSE SIZES SHALL BE COORDINATED WITH SHOP DRAWINGS PRIOR TO ORDERING OR INSTALLING. ANY EQUIPMENT INSTALLED INCORRECTLY BECAUSE OF LACK OF COORDINATION WILL BE REMOVED AND INSTALLED CORRECTLY AT THE EXPENSE OF THE ELECTRICAL CONTRACTOR.
E. THE ELECTRICAL CONTRACTOR SHALL COORDINATE ALL CONDUIT RUNS AND LIGHT FIXTURE LOCATIONS ABOVE THE CEILING WITH OTHER TRADES PRIOR TO INSTALLATION.
F. ALL DUCT SMOKE DETECTORS SHALL BE PROVIDED AND CONNECTED BY THE ELECTRICAL CONTRACTOR, BUT INSTALLED BY THE MECHANICAL CONTRACTOR.
G. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY OUTLETS FOR HEAT TAPE CONNECTIONS FOR MECHANICAL SYSTEMS. PROVIDE CLASS B (30mA) GFCI PROTECTION ON THE BREAKER SUPPLYING THE HEAT TAPE.
H. THE ELECTRICAL CONTRACTOR SHALL PROVIDE 120V POWER AT EACH HVAC UNIT HAVING A CONTROLS POWER SUPPLY. CIRCUIT(S) SHALL BE DEDICATED 20A SERVING A MAXIMUM OF 10 HVAC UNITS PER CIRCUIT. COORDINATE ALL LOCATIONS WITH THE MECHANICAL CONTRACTOR.

8. DEMOLITION NOTES:

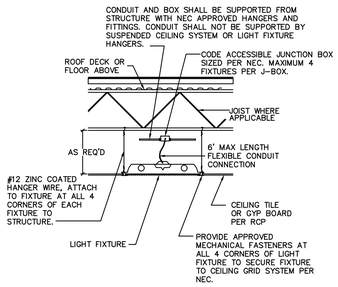
A. PARTIAL AND TOTAL DEMOLITION OF PORTIONS SHALL BE PERFORMED ALONG WITH ALL NECESSARY MODIFICATIONS TO THAT PORTION OF THE EXISTING BUILDING WHICH SHALL REMAIN SO THAT IT CONTINUES TO FUNCTION UNAFFECTED BY THE DEMOLITION AND ASSOCIATED NEW CONSTRUCTION.
B. WHERE INCLUDED AS PART OF THE CONTRACT DOCUMENTS, THE DRAWINGS INDICATE THE GENERAL AREAS OF WORK INVOLVED. HOWEVER, THE ELECTRICAL CONTRACTOR SHALL PERFORM WORK OUTSIDE THOSE AREAS SHOWN AS IS NECESSARY TO COMPLY WITH THE INTENT OF THIS SECTION.
C. THE ELECTRICAL CONTRACTOR SHALL FAMILIARIZE THEMSELVES WITH THE EXISTING BUILDING AND WITH THE WORK OF ALL OTHER TRADES AND INCLUDE ALL WORK NECESSARY TO COMPLY WITH THE INTENT OF THE DEMOLITION.
D. IT SHALL BE UNDERSTOOD THAT FIELD CONDITIONS MAY BE ENCOUNTERED DURING THE EXECUTION OF THIS CONTRACT WHICH WILL REQUIRE EXTENSION OR RELOCATION OF EXISTING SYSTEMS OR EQUIPMENT WHICH ARE NOT SPECIFICALLY SHOWN ON THE DRAWINGS, BUT WHICH ARE REQUIRED TO MEET THE STATED INTENT THAT THE BUILDING CONTINUE TO FUNCTION UNAFFECTED BY THE DEMOLITION AND ASSOCIATED NEW CONSTRUCTION. THE ELECTRICAL CONTRACTOR SHALL INCLUDE SUCH WORK AS WOULD NORMALLY BE EXPECTED IN AN EXISTING BUILDING OF THIS AGE AND TYPE.
E. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL TOOLS, EQUIPMENT, LABOR, ETC. IN ORDER TO ACCOMPLISH THE DEMOLITION PORTION OF THE PROJECT.
F. THE DEMOLITION OF CERTAIN AREAS OF THE EXISTING BUILDING SHALL BE PERFORMED BY THE GENERAL CONTRACTOR. IT SHALL BE THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH THE GENERAL CONTRACTOR TO DIFFERENTIATE THE SCOPE OF WORK BETWEEN SEPARATE TRADES.
G. THE ELECTRICAL CONTRACTOR SHALL INCLUDE COORDINATION WITH THE GENERAL CONTRACTOR AND SUCH DEMOLITION OF THE EXISTING ELECTRICAL SYSTEMS AS IS NECESSARY SO THAT THE DEMOLITION WORK OF THE GENERAL CONTRACTOR SHALL NOT DAMAGE THOSE PORTIONS OF THE ELECTRICAL SYSTEMS WHICH ARE TO REMAIN IN SERVICE, ARE TO BE REUSED, OR ARE TO BECOME THE PROPERTY OF THE OWNER.
H. TURN OVER TO OWNER, UPON REQUEST OR AS NOTED, ITEMS SHOWN AS BEING REMOVED AND NOT REINSTALLED. ITEMS NOT DIRECTED OR REQUESTED TO BE TURNED OVER TO THE OWNER SHALL BE DISPOSED OF BY THE ELECTRICAL CONTRACTOR.
I. EQUIPMENT OR MATERIALS WHICH ARE TO BE REUSED OR TURNED OVER TO THE OWNER SHALL BE CAREFULLY REMOVED, CLEANED, AND STORED IN A CLEAN AND DRY AREA. SHOULD THE ELECTRICAL CONTRACTOR ENCOUNTER SUCH EQUIPMENT WHICH IS NOT IN SATISFACTORY CONDITION FOR REUSE AND NOT IN WORKING ORDER, THE ELECTRICAL CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY.
J. DISCONNECT ELECTRICAL SERVICES TO ALL EQUIPMENT REQUIRING REMOVAL. CONDUIT SHALL BE REMOVED BACK TO THE POINT WHERE IT WILL BE CONCEALED AT THE COMPLETION OF THIS CONTRACT. WIRE AND CABLE SHALL BE REMOVED BACK TO THE FIRST OUTLET BOX, CABINET, OR TERMINATION POINT WHICH IS TO REMAIN. CIRCUITS WHICH ARE NOT REUSED SHALL BE REMOVED BACK TO THE SOURCE IN THEIR ENTIRETY.
K. REMOVE AND REINSTALL CEILINGS IN THE EXISTING BUILDING AS REQUIRED FOR THE WORK. COORDINATE WITH THE GENERAL CONTRACTOR. IN SUCH AREAS, REMOVE AND REINSTALL ALL ELECTRICAL DEVICES WHICH ARE TO REMAIN IN OR ON THE CEILING.
L. WHERE NEW CEILINGS CONFLICT WITH EXISTING ELECTRICAL WORK WHICH IS TO REMAIN, RELOCATE THE ELECTRICAL WORK INVOLVED TO CLEAR THE NEW CONSTRUCTION.
M. WHERE NEW WALL OR FLOOR FINISHES CONFLICT WITH EXISTING ELECTRICAL WORK WHICH IS TO REMAIN, RELOCATE THE ELECTRICAL WORK INVOLVED OR PROVIDE BOX EXTENSIONS OR SIMILAR DEVICES AND REINSTALL ON THE NEW FINISH.
N. WHERE E



NOTE:
DO NOT MOUNT POWER PACKS CLOSER THAN 6-12 INCHES FROM SENSOR. PROVIDE DOUBLE STACKED JUNCTION BOX FOR MAXIMUM VENTILATION OF POWER PACK. PROVIDE BLANK COVER, WHERE PERMITTED BY CODE AND AHJ, LEAVE (2) OPENINGS IN CONDUIT KNOCKOUT FOR VENTING OF POWER PACK. VERIFY WITH AHJ PRIOR TO KNOCKOUT REMOVAL.

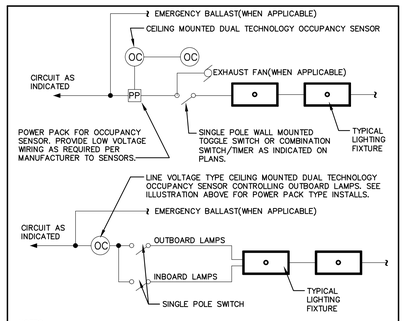
POWER PACK
INSTALLED IN J-BOX

1 POWER PACK INSTALLATION



NOTES:
1. WHERE ROOF DECKING IS THE ALLOWABLE SUPPORT STRUCTURE, AND PATHWAY SYSTEM IS NOT IMC OR RMC, THE MINIMUM DISTANCE FROM ROOF DECKING SHALL BE 1.5" FOR ALL BOXES AND CONDUIT.

2 TYPICAL LAY-IN FIXTURE DIAGRAM
NO SCALE



NOTES:
1. OCCUPANCY SENSORS SHALL BE SET TO TIME OUT AFTER 15 MINUTES AND THE TRIM POTENTIOMETER IS SET TO 90% FOR SENSITIVITY.
2. OCCUPANCY SENSORS SHALL BE PLACED AS TO NOT FUNCTION UPON SOMEONE JUST PASSING BY THE ROOM DOOR BUT BY ACTUALLY ENTERING THE ROOM IN AS MUCH AS POSSIBLE.

3 TYPICAL CEILING MOUNTED OCCUPANCY SENSOR WIRING DIAGRAMS
NO SCALE

FIRE ALARM SYSTEM MATRIX | BUILDING SYSTEM OUTPUTS

	ACTIVATE COMMON ALARM SIGNAL INDICATOR	ACTIVATE AUDIBLE ALARM SIGNAL	ACTIVATE COMMON SUPERVISORY SIGNAL INDICATOR	ACTIVATE AUDIBLE SUPERVISORY SIGNAL	ACTIVATE COMMON TROUBLE SIGNAL INDICATOR	ACTIVATE AUDIBLE TROUBLE SIGNAL	DISPLAY CHANGE OF DEVICE SIGNAL INDICATOR	ACTIVATE GENERAL EVACUATION SIGNAL	ACTIVATE ADDRESS ALARM SIGNAL	ACTIVATE ROOM STROBE	ACTIVATE SINGLE SUITE SOUNDER IN CO DETECTOR	TRANSMIT FIRE ALARM SIGNAL TO BUILDING SOUNDER BASES	TRANSMIT SUPERVISORY SIGNAL TO BUILDING SOUNDER BASES	TRANSMIT TROUBLE SIGNAL TO BUILDING SOUNDER BASES	DELAYED REMOVAL OF POWER FROM ELEVATOR	TRANSMIT TRIP ALARM SIGNAL TO CONTROL STATION	RETURN ELEVATOR TO ALTERNATE FLOOR	RETURN ELEVATOR TO FIRST FLOOR	SHUNT TRIP AFTER DELAY	CLOSE ALL FIRE/SMOKE DAMPERS	UNLOCK ALL EGRESS DOORS	ACTIVATE MAGNETICALLY HELD DOORS	ACTIVATE STAIRWAY PRESSURIZATION	SHOW CHANGE OF STATUS ON ANNUNCIATOR	SHOW CHANGE OF STATUS ON CONTROL PANEL	ACTIVATE EXTERNAL HORNS/STROBES
CARBON MONOXIDE DETECTOR			X	X			X		X		X	X								X	X	X	X				
DUCT SMOKE DETECTOR			X	X			X	X	X		X		X								X	X					

4 FIRE ALARM MATRIX
NOT TO SCALE

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11-6-23

wesley chapel elementary school
ROOFTOP UNIT REPLACEMENT
110 potter road
monroe, nc 28110

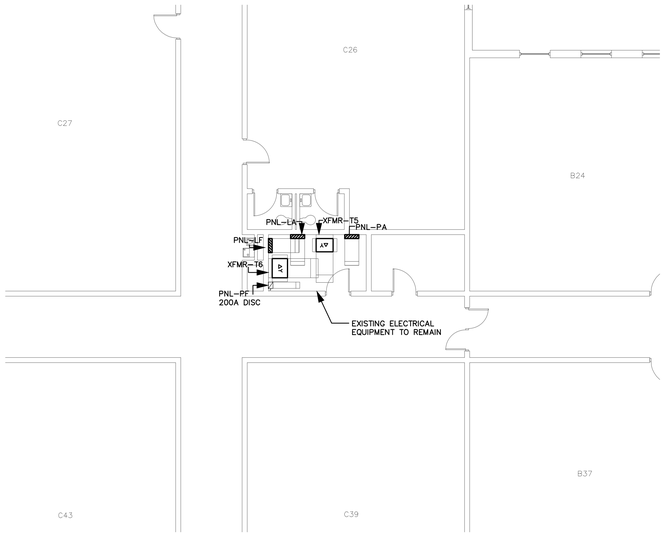
REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: SMT
DESIGNED BY: SMT
CHECKED BY: MAM

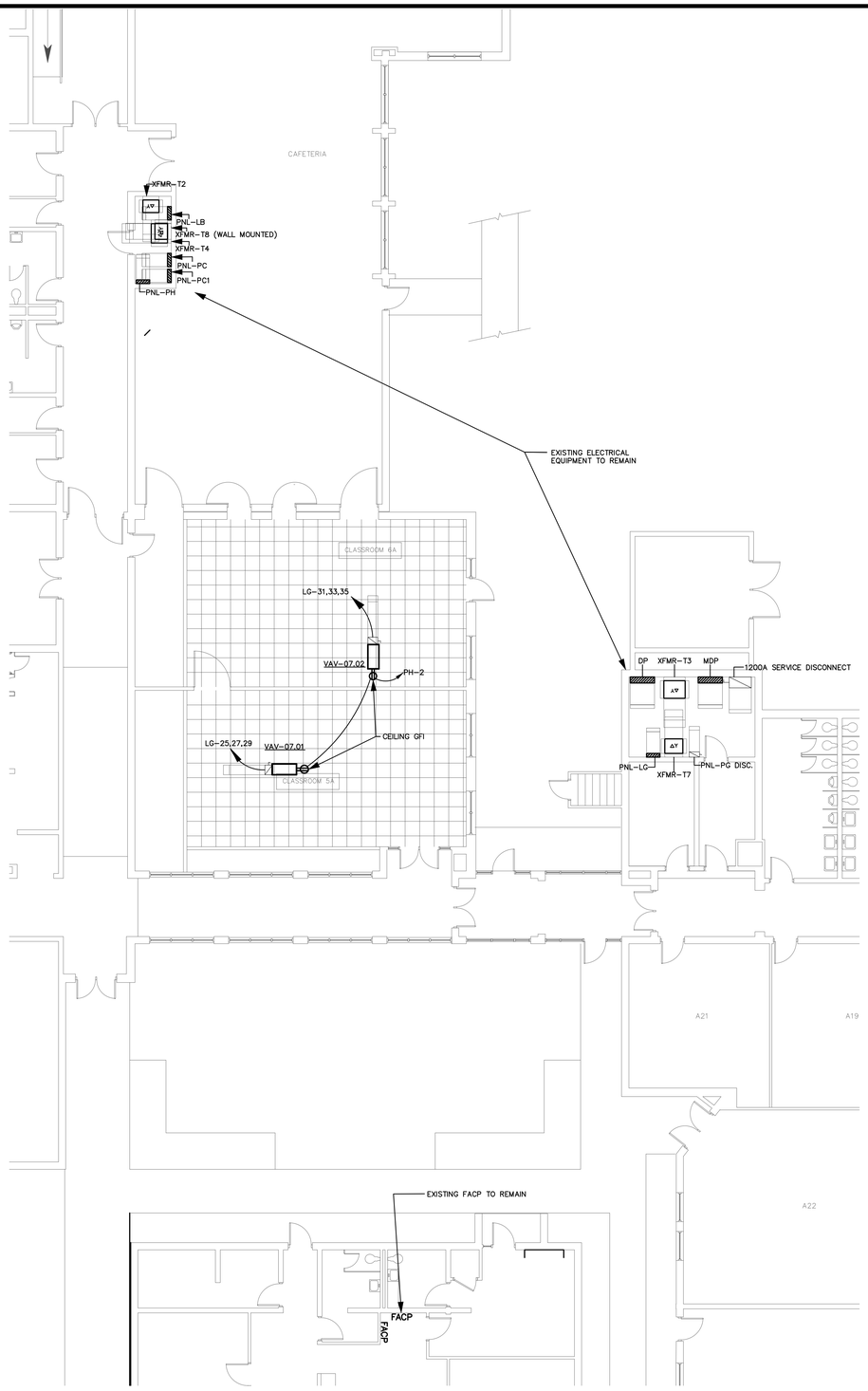
SHEET TITLE:
ELECTRICAL DETAILS

DWG #: E002

SHEET NO: 2 of 6



1 ELECTRICAL ROOM LOCATION - JANITOR CLOSET
1/8" = 1'-0"



2 ELECTRICAL ROOM LOCATIONS - MAIN AND CLOSET
1/8" = 1'-0"

KEYPLAN

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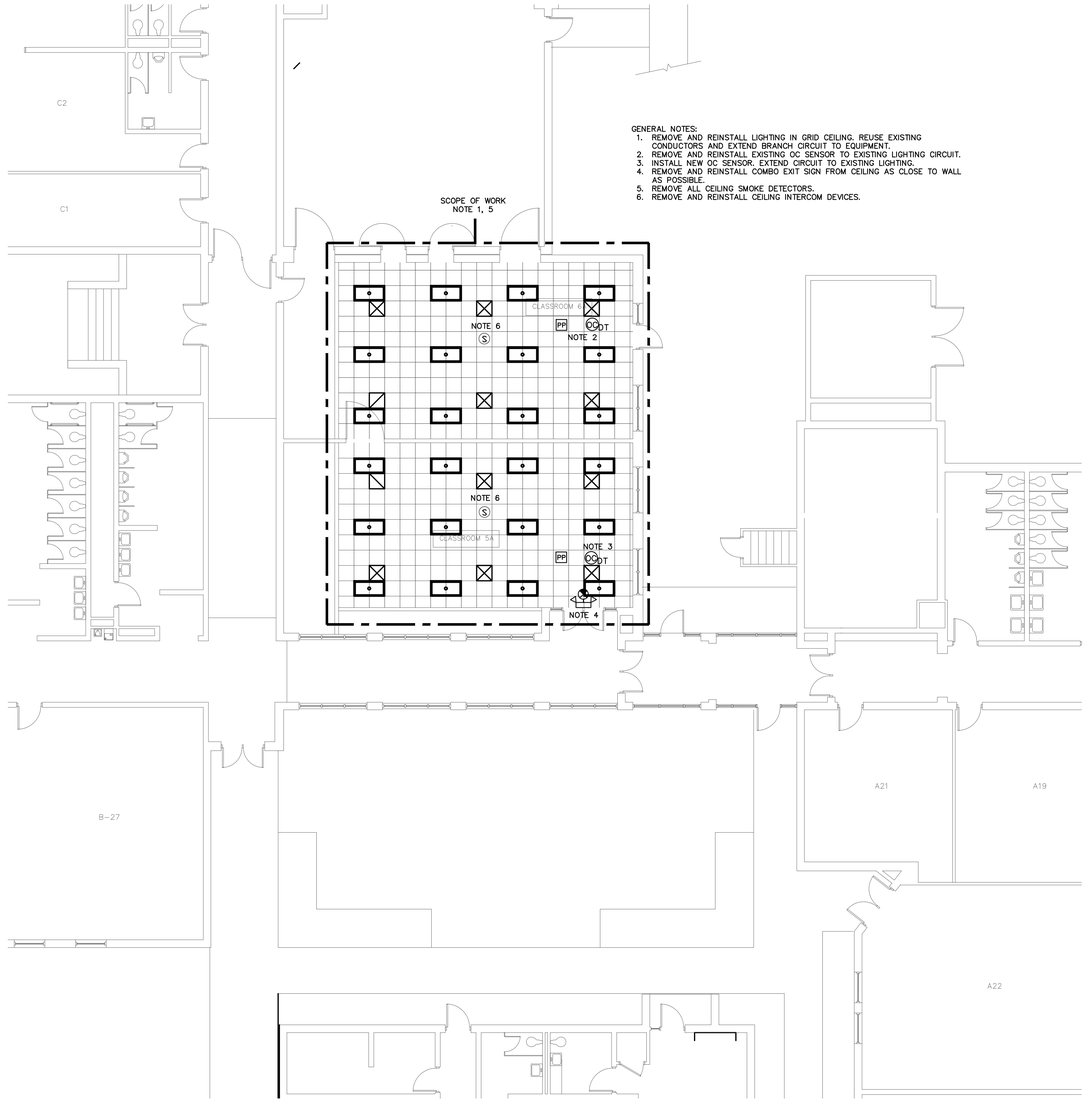
REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: SMT
DESIGNED BY: SMT
CHECKED BY: MAM

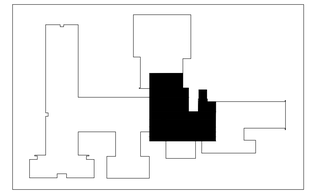
SHEET TITLE:
ENLARGED ELECTRICAL ROOM PANEL LOCATIONS

DWG #:
E200
SHEET NO: 3 of 6



GENERAL NOTES:
1. REMOVE AND REINSTALL LIGHTING IN GRID CEILING. REUSE EXISTING CONDUCTORS AND EXTEND BRANCH CIRCUIT TO EQUIPMENT.
2. REMOVE AND REINSTALL EXISTING OC SENSOR TO EXISTING LIGHTING CIRCUIT.
3. INSTALL NEW OC SENSOR. EXTEND CIRCUIT TO EXISTING LIGHTING.
4. REMOVE AND REINSTALL COMBO EXIT SIGN FROM CEILING AS CLOSE TO WALL AS POSSIBLE.
5. REMOVE ALL CEILING SMOKE DETECTORS.
6. REMOVE AND REINSTALL CEILING INTERCOM DEVICES.

1 ELECTRICAL CEILING - CLASSROOMS 5A + 6A
1/8" = 1'-0"



KEYPLAN

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REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: SMT
DESIGNED BY: SMT
CHECKED BY: MAM

SHEET TITLE:
ENLARGED CEILING CLASSROOMS 5A & 6A

DWG #:
E201

SHEET NO: 4 of 6

1 ELECTRICAL ROOF PLAN - NEW WORK
1/16" = 1'-0"

GENERAL NOTES:
1. DISCONNECT SHOWN IS NEW FOR EACH RTU. EXTEND BRANCH CIRCUIT FROM INTERCEPT POINT OF DISCONNECT TO NEW UNIT.

KEY NOTE:
1. REINSTALL WP GFI TO EXISTING 120V, 20A CIRCUIT.
2. REMOVE EXISTING ROOFTOP UNITS AS SHOWN ON MECHANICAL PLANS. REUSE EXISTING CONDUCTORS, EXTEND BRANCH CIRCUIT TO NEW EQUIPMENT CONNECTION.
3. INSTALL NEW WP GFI TO EXISTING 120V, 20A CIRCUIT.
4. CONNECT ION FILTER TO LOCAL RECEPTACLE CIRCUIT.

(CO) CARBON MONOXIDE DETECTOR REQUIRED AT FIRST ROOM SERVED BY UNIT.

(D07) REMOVE AND REINSTALL DUCT DETECTOR.

DEMO NOTES:
1. EXTEND EXISTING CONDUIT & CONDUCTORS FOR NEW CONNECTION POINTS.

ROOFTOP UNIT SCHEDULE - (DX COOLING WITH GAS HEAT - RTU-1,2,5,6) (RTU-7 COOLING ONLY)

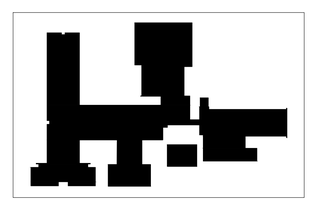
SYMBOL	COMPRESSORS			OFM		IFM		POWER EXH. (EA)		POWER SUPPLY			DISCONNECT	CIRCUIT (CU)
	NO.	RLA	LRA	QTY.	FLA	QTY	HP	QTY.	HP	FLA	MCA	MOCP	VOLTAGE		DISCONNECT LOAD SIDE
RTU-1	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3#8,1#10G,3/4"C
RTU-2	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3#8,1#10G,3/4"C
RTU-3	EXISTING RTU TO REMAIN													EXISTING RTU TO REMAIN	
RTU-4	EXISTING RTU TO REMAIN													EXISTING RTU TO REMAIN	
RTU-5	2			2	1.8	1	4.0	1	4.0	3.5	20	25	460V-3ø	30/F25-3P-3R	3#10,1#10G,3/4"C
RTU-6	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3#8,1#10G,3/4"C
RTU-7	2			2	1.8	1	8.0	1	4.0	3.5	24	30	460V-3ø	60/F30-3P-3R	3#10,1#10G,3/4"C

AIR HANDLING UNIT SCHEDULE - (DX COOLING WITH GAS HEAT, SINGLE ZONE VAV)

SYMBOL	COMPRESSORS		OFM		IFM		POWER EXH. (EA)		POWER SUPPLY			DISCONNECT	CIRCUIT (CU)
	NO.	AMPS	QTY.	FLA	QTY	HP	QTY.	HP	FLA	MCA	MOCP	VOLTAGE		DISCONNECT LOAD SIDE
AHU-1	1	30.1	2	5.2	1	10.0	1	4.0	4.0	59.3	80	460V-3ø	100/F80-3P-3R	3#4,1#8G,1-1/4"C

VAV BOX SCHEDULE

SYMBOL	CFM		HEATING CFM	ELEC. HEAT (KW)	VOLTAGE/ø	DISCONNECT	CIRCUIT (CU) DISCONNECT LOAD SIDE	
	MAXIMUM	MINIMUM						
07.01	1250	250	750	10	460V/3ø	30/F20-3P	4#12,1#12G,3/4"C	
07.02	1250	250	750	10	460V/3ø	30/F20-3P	4#12,1#12G,3/4"C	



KEYPLAN

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REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: SMT
DESIGNED BY: SMT
CHECKED BY: MAM

SHEET TITLE:
ELECTRICAL ROOF PLAN

DWG #:
E202
SHEET NO: 5 of 6

EXISTING PANEL: MDP

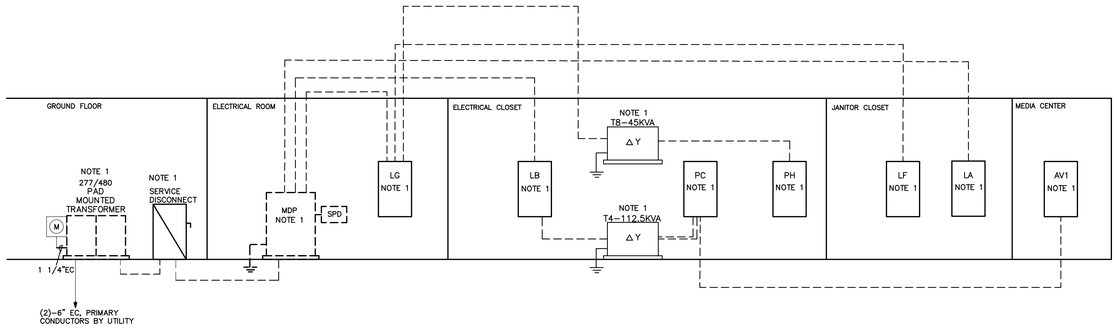
EXTG MFGR

VOLTAGE: 277 / 480 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 1200 AMP — MAIN LUGS ONLY — 65,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
18.70		EX			1		2			EX		9.68
19.50	PANEL BRA (EXISTING)	EX	100		3		4		50	EX	PANEL LC (EXISTING)	8.47
18.40		EX			5		6			EX		9.54
30.50		EX			7		8			EX		12.20
32.60	PANEL DP VIA T3 (EXISTING)	EX	200		9		10		150	EX	PANEL LA (EXISTING)	11.80
30.20		EX			11		12			EX		10.80
36.50		EX			13		14			EX		32.15
36.85	PANEL KPA (EXISTING)	EX	350		15		16		400	EX	PANEL LB (EXISTING)	32.80
36.70		EX			17		18			EX		32.80
45.20		EX			19		20			EX		80.96
45.10	CHILLER (EXISTING)	EX	400		21		22		600	EX	PANEL LG (EXISTING)	86.26
45.80		EX			23		24			EX		77.16
0.00					25		26					0.00
0.00	SPACE ONLY				27		28				SPACE ONLY	0.00
0.00					29		30					0.00
0.00	SPACE ONLY				31		32				SPACE ONLY	0.00
0.00	SPACE ONLY				33		34				SPACE ONLY	0.00
0.00	SPACE ONLY				35		36				SPACE ONLY	0.00
0.00	SPACE ONLY				37		38				SPACE ONLY	0.00
0.00	SPACE ONLY				39		40				SPACE ONLY	0.00
0.00	SPACE ONLY				41		42				SPACE ONLY	0.00
396.1						SUB-TOTALS						404.6

	LOAD (KVA)	Conn	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	67.0	1.25	83.7	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	265.9 KVA	959.4 A
	COOLING	164.8	1.00	164.8	B =	273.4 KVA	986.5 A
	VENTILATION	20.6	1.00	20.6	C =	261.4 KVA	943.2 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	110.1	0.65	71.5	A =	258.8 KVA	933.7 A
	REC. (1st 10kVA)	3.4	1.00	3.4	B =	265.8 KVA	958.9 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	254.4 KVA	918.0 A
	WATER HEATER	4.4	1.00	4.4	DEMAND @ 125%		
	MISC.	430.5	1.00	430.5	A =	323.5 KVA	1167.1 A
	SPARE	0.0	1.00	0.0	B =	332.2 KVA	1198.7 A
	TOTAL (KVA)	800.7		778.9	C =	318.0 KVA	1147.4 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.



NOTES:
1. ALL EQUIPMENT SHOWN IS EXISTING AND TO REMAIN IN PLACE

1 POWER RISER DIAGRAM

NO SCALE

PANEL DESIGNATION	MDP
VOLTAGE	277/480V
AMPERAGE	1200
DESIGNED LOAD CAP (KVA)	797.8
EXISTING LOAD (KVA)	778.4
INCREASING LOAD (KVA)	12.56

PANEL DESIGNATION	LF
VOLTAGE	277/480V
AMPERAGE	400A
DESIGNED LOAD CAP (KVA)	265.9
EXISTING LOAD (KVA)	63.9
INCREASING LOAD (KVA)	0

PANEL DESIGNATION	LG
VOLTAGE	277/480V
AMPERAGE	600A
DESIGNED LOAD CAP (KVA)	398.8
EXISTING LOAD (KVA)	248.7
INCREASING LOAD (KVA)	12.54

PANEL DESIGNATION	LA
VOLTAGE	277/480V
AMPERAGE	225A
DESIGNED LOAD CAP (KVA)	149.6
EXISTING LOAD (KVA)	37.1
INCREASING LOAD (KVA)	0

PANEL DESIGNATION	LB
VOLTAGE	277/480V
AMPERAGE	400A
DESIGNED LOAD CAP (KVA)	265.9
EXISTING LOAD (KVA)	100.4
INCREASING LOAD (KVA)	0.02

PANEL DESIGNATION	AV1
VOLTAGE	120/208V
AMPERAGE	125A
DESIGNED LOAD CAP (KVA)	36
EXISTING LOAD (KVA)	16.4
INCREASING LOAD (KVA)	0.02

PANEL DESIGNATION	PC
VOLTAGE	120/208V
AMPERAGE	400A
DESIGNED LOAD CAP (KVA)	115.2
EXISTING LOAD (KVA)	329
INCREASING LOAD (KVA)	0.02

PANEL DESIGNATION	PH
VOLTAGE	120/208V
AMPERAGE	250A
DESIGNED LOAD CAP (KVA)	72
EXISTING LOAD (KVA)	12.8
INCREASING LOAD (KVA)	0.54

EXISTING PANEL: LF

EXTG MFGR

VOLTAGE: 277 / 480 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 400 AMP — MAIN CIRCUIT BREAKER — 22,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
1.50	MEDIA CENTER LTS (EXISTING)	EX	20		1		2		20		SPARE	0.00
3.60	MEDIA CENTER LTS (EXISTING)	EX	20		3		4		20	EX	CLASSROOM LTS (EXISTING)	1.40
3.60	MEDIA CENTER LTS (EXISTING)	EX	20		5		6		20	EX	CLASSROOM LTS (EXISTING)	2.50
2.80		EX			7		8		20	EX	CLASSROOM LTS (EXISTING)	2.50
2.80	E.R.U CLASS WING (EXISTING)	EX	15		9		10					**2.00**
2.80		EX			11		12		90	EX	RTU-1	**2.00**
0.00	SPACE ONLY				13		14			EX		**2.00**
0.00	SPACE ONLY				15		16			EX		**2.00**
0.00	SPACE ONLY				17		18		90	EX	RTU-2	**2.00**
0.00	SPACE ONLY				19		20			EX		**2.00**
0.00	SPACE ONLY				21		22				SPACE ONLY	0.00
0.00	SPACE ONLY				23		24				SPACE ONLY	0.00
0.00	SPACE ONLY				25		26				SPACE ONLY	0.00
0.00	SPACE ONLY				27		28				SPACE ONLY	0.00
0.00	SPACE ONLY				29		30				SPACE ONLY	0.00
0.00	SPACE ONLY				31		32				SPACE ONLY	0.00
0.00	SPACE ONLY				33		34				SPACE ONLY	0.00
0.00	SPACE ONLY				35		36				SPACE ONLY	0.00
0.00	SPACE ONLY				37		38			EX		8.70
0.00	SPACE ONLY				39		40		125	EX	PANEL PF VIA XFMR T6 (EXISTING)	9.70
0.00	SPACE ONLY				41		42			EX		6.20
17.1						SUB-TOTALS						43.0

	LOAD (KVA)	Conn	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	15.1	1.25	18.9	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	19.5 KVA	70.4 A
	COOLING	12.0	1.00	12.0	B =	21.5 KVA	77.6 A
	VENTILATION	0.0	1.00	0.0	C =	19.1 KVA	68.9 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	20.5 KVA	74.0 A
	REC. (1st 10kVA)	0.0	1.00	0.0	B =	22.8 KVA	82.1 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	20.6 KVA	74.4 A
	WATER HEATER	0.0	1.00	0.0	DEMAND @ 125%		
	MISC.	33.0	1.00	33.0	A =	25.6 KVA	92.5 A
	SPARE	0.0	1.00	0.0	B =	28.4 KVA	102.6 A
	TOTAL (KVA)	60.1		63.9	C =	25.8 KVA	93.0 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.

EXISTING PANEL: LA

EXTG MFGR

VOLTAGE: 277 / 480 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 225 AMP — MAIN CIRCUIT BREAKER — 22,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
0.70	CORR LTS (EXISTING)	EX	20		1		2		20	EX	CLASS LTS (EXISTING)	0.40
0.40	CLASS LTS (EXISTING)	EX	20		3		4		20	EX	CLASS LTS (EXISTING)	0.40
0.40	CLASS LTS (EXISTING)	EX	20		5		6		20	EX	CLASS LTS (EXISTING)	0.40
0.40	CLASS LTS (EXISTING)	EX	20		7		8		20	EX	CLASS LTS (EXISTING)	0.40
0.40	CLASS LTS (EXISTING)	EX	20		9		10		20	EX	CLASS LTS (EXISTING)	0.40
0.50	MEDIA LTS (EXISTING)	EX	20		11		12		20	EX	CLASS LTS (EXISTING)	0.40
0.50	MEDIA LTS (EXISTING)	EX	20		13		14		20	EX	CLASS LTS (EXISTING)	0.40
0.60	STOR LTS (EXISTING)	EX	20		15		16		20	EX	OUTSIDE LTS (EXISTING)	0.70
0.40	CLASS LTS (EXISTING)	EX	20		17		18				SPACE ONLY	0.00
1.50		EX			19		20		20	EX	OUTSIDE NEW BLD (EXISTING)	0.50
1.50	AHU-1 (EXISTING)	EX	15		21		22		20	EX	CLASS LTS (EXISTING)	0.40
1.50		EX			23		24		20	EX	TEACHER LOUNGE (EXISTING)	0.20
7.00		EX			25		26		20	EX	CLASS LTS (EXISTING)	0.40
7.00	XFMR T5 (EXISTING)	EX	70		27		28				SPACE ONLY	0.00
7.00		EX			29		30				SPACE ONLY	0.00
0.00					31		32					0.00
0.00					33		34					0.00
0.00					35		36					0.00
0.00					37		38					0.00
0.00					39		40					0.00
0.00					41		42					0.00
29.8						SUB-TOTALS						5.0

	LOAD (KVA)	Conn	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	9.3	1.25	11.6	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	12.2 KVA	44.0 A
	COOLING	4.5	1.00	4.5	B =	11.8 KVA	42.6 A
	VENTILATION	0.0	1.00	0.0	C =	10.8 KVA	39.0 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	13.1 KVA	47.4 A
	REC. (1st 10kVA)	0.0	1.00	0.0	B =	12.6 KVA	45.6 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	11.4 KVA	41.0 A
	WATER HEATER	0.0	1.00	0.0	DEMAND @ 125%		
	MISC.	21.0	1.00	21.0	A =	16.4 KVA	59.2 A
	SPARE	0.0	1.00	0.0	B =	15.8 KVA	56.9 A
	TOTAL (KVA)	34.8		37.1	C =	14.2 KVA	51.3 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.

EXISTING PANEL: LB

EXTG MFGR

VOLTAGE: 277 / 480 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 175 AMP — MAIN CIRCUIT BREAKER — 22,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
5.65		EX			1		2				SPACE ONLY	0.00
8.60	AC (EXSITING)	EX	40		3		4				SPACE ONLY	0.00
7.45		EX			5		6				SPACE ONLY	0.00
0.70	LTS (EXISTING)	EX	20		7		8		20	EX	KITCHEN LTS (EXISTING)	3.00
0.70	LTS (EXISTING)	EX	20		9		10		20	EX	DINING LTS (EXISTING)	1.30
0.70	LTS (EXISTING)	EX	20		11		12		20	EX	ART LTS (EXISTING)	3.50
0.70	LTS (EXISTING)	EX	20		13		14			EX		1.00
8.50		EX			15		16		15	EX	A1-3 (EXISTING)	1.00
7.65	PANEL PH VIA XFMR T8 (EXISTING)	EX	100		17		18			EX		1.00
7.80		EX			19		20			EX		1.50
2.30		EX			21		22		15	EX	AHU-2 (EXISTING)	1.50
2.30	SUMP PUMP (EXISTING)	EX	40		23		24			EX		1.50
2.30		EX			25		26			EX		9.50
0.00	SPACE ONLY				27		28		175	EX	PANEL PH VIA XFMR T8 (EXISTING)	8.90
0.00	SPACE ONLY				29		30			EX		8.70
0.00					31		32					0.00
0.00					33		34					0.00
0.00					35		36					0.00
0.00					37		38					0.00
0.00					39		40					0.00
0.00					41		42					0.00
55.4						SUB-TOTALS						42.4

	LOAD (KVA)	Conn.	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	10.6	1.25	13.3	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	32.2 KVA	116.0 A
	COOLING	26.2	1.00	26.2	B =	32.8 KVA	118.4 A
	VENTILATION	0.0	1.00	0.0	C =	32.8 KVA	118.4 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	33.3 KVA	120.0 A
	REC. (1st 10kVA)	0.0	1.00	0.0	B =	33.3 KVA	120.2 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	33.9 KVA	122.1 A
	WATER HEATER	0.0	1.00	0.0	DEMAND @ 125%		
	MISC.	61.0	1.00	61.0	A =	41.6 KVA	150.0 A
	SPARE	0.0	1.00	0.0	B =	41.6 KVA	150.2 A
	TOTAL (KVA)	97.8		100.4	C =	42.3 KVA	152.7 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.

EXISTING PANEL: LG

EXTG MFGR

VOLTAGE: 277 / 480 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 600 AMP — MAIN LUGS ONLY — 22,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
0.30	BREEZEWAY LTS (EXISTING)	EX	20		1		2			EX		14.20
1.50	ART COR/RR LTS (EXISTING)	EX	20		3		4		60	EX	RTU-3 (EXISTING)	14.20
1.20	ART ROOM LTS (EXISTING)	EX	20		5		6			EX		14.20
2.00		**2**			7		8		20	EX	EXT BUILDING LTS (EXISTING)	0.50
2.00	RTU-6 (NOTE 2)	**2**	**35**		9		10		20	EX	EXT BUILDING LTS (EXISTING)	0.80
2.00		**2**			11		12				SPACE ONLY	0.00
1.50		**2**			13		14				SPACE ONLY	0.00
1.50	RTU-5 (NOTE 2)	**2**	**25**		15		16				SPACE ONLY	0.00
1.50		**2**			17		18				SPACE ONLY	0.00
21.00		EX			19		20		**4**			2.00
21.00	RTU-4 (EXISTING)	EX	80		21		22		**4**		RTU-7 (NOTE 1)	2.00
21.00		EX			23		24		**4**			2.00
3.33		**4**			25		26				SPACE ONLY	0.00
3.33	**VAV 7.1 (NOTE 1)**	**4**	**20**		27		28				SPACE ONLY	0.00
3.33		**4**			29		30				SPACE ONLY	0.00
3.33		**4**			31		32			EX		4.60
3.33	**VAV 7.2 (NOTE 1)**	**4**	**20**		33		34		70	EX	PANEL PH VIA XFMR T8 (EXISTING)	5.40
3.33		**4**			35		36			EX		3.30
19.50		EX			37		38			EX		8.70
21.50	PANEL LF (EXISTING)	EX	400		39		40		125	EX	PANEL PG VIA XFMR T7 (EXISTING)	9.70
19.10		EX			41		42			EX		6.20
156.6						SUB-TOTALS						87.8

	LOAD (KVA)	Conn	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	19.4	1.25	24.3	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	81.0 KVA	292.1 A
	COOLING	134.1	1.00	134.1	B =	86.3 KVA	311.3 A
	VENTILATION	20.6	1.00	20.6	C =	77.2 KVA	278.4 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	82.2 KVA	296.5 A
	REC. (1st 10kVA)	3.4	1.00	3.4	B =	88.1 KVA	317.8 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	79.0 KVA	285.0 A
	WATER HEATER	4.4	1.00	4.4	DEMAND @ 125%		
	MISC.	62.5	1.00	62.5	A =	102.7 KVA	370.6 A
	SPARE	0.0	1.00	0.0	B =	110.1 KVA	397.3 A
	TOTAL (KVA)	244.4		249.2	C =	98.7 KVA	356.3 A

NOTES:
1. PROVIDE NEW BREAKER, CONDUIT AND CONDUCTORS AS SHOWN.
2. REMOVE EXISTING BREAKER & PROVIDE NEW BREAKER AS SHOWN. BREAKER INCREASING IN SIZE. PROVIDE NEW CONDUCTOR AND CONDUIT SIZED AS SHOWN.
3. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.

EXISTING PANEL: AV1

EXTG MFGR

VOLTAGE: 120 / 208 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 125 AMP — MAIN CIRCUIT BREAKER — 10,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
1.40	COMPUTER REC (EXISTING)	EX	20		1		2		20	EX	AV STORAGE REC (EXISTING)	1.40
1.20	COMPUTER REC (EXISTING)	EX	20		3		4		20	EX	FRONT DESK REC (EXISTING)	1.20
1.20	COMPUTER REC (EXISTING)	EX	20		5		6		20	EX	BOOK SCANNER (EXISTING)	0.20
1.20	COMPUTER REC (EXISTING)	EX	20		7		8		20	EX	PROD WORK REC (EXISTING)	0.90
1.20	MEDIA REC (EXISTING)	EX	20		9		10		20	EX	COPY MACHINE (EXISTING)	1.20
1.00	PROJECT SCREEN (EXISTING)	EX	20		11		12		20	EX	OFFICE WORK REC (EXISTING)	0.60
1.40	MEDIA REC (EXISTING)	EX	20		13		14		20	EX	SMART BOARD (EXISTING)	1.00
1.00	PROJECT SCREEN (EXISTING)	EX	20		15		16		20	EX	MEDIA RETRIEVAL (EXISTING)	1.00
1.00	MDP (EXISTING)	EX	20		17		18		20	EX	MEDIA CENTER REC (EXISTING)	1.20
1.00	MDP (EXISTING)	EX	20		19		20		20	EX	FAEP (EXISTING)	0.20
0.00					21		22				SPACE ONLY	0.00
0.00					23		24					0.00
0.00					25		26					0.00
0.00					27		28					0.00
0.00					29		30					0.00
0.00					31		32					0.00
0.00					33		34					0.00
0.00					35		36					0.00
0.00					37		38					0.00
0.00					39		40					0.00
0.00					41		42					0.00
11.6						SUB-TOTALS						8.9

	LOAD (KVA)	Conn.	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	0.0	1.25	0.0	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	8.5 KVA	70.8 A
	COOLING	0.0	1.00	0.0	B =	6.8 KVA	56.6 A
	VENTILATION	0.0	1.00	0.0	C =	5.2 KVA	43.3 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	6.8 KVA	57.0 A
	REC. (1st 10kVA)	10.0	1.00	10.0	B =	5.3 KVA	43.8 A
	REC. (>10kVA)	8.3	0.50	4.2	C =	4.2 KVA	35.4 A
	WATER HEATER	0.0	1.00	0.0	DEMAND @ 125%		
	MISC.	2.2	1.00	2.2	A =	6.6 KVA	71.2 A
	SPARE	0.0	1.00	0.0	B =	6.6 KVA	54.7 A
	TOTAL (KVA)	20.5		16.4	C =	5.3 KVA	44.2 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.

EXISTING PANEL: PH

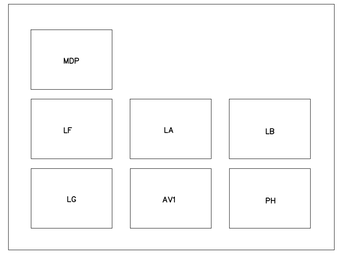
EXTG MFGR

VOLTAGE: 120 / 208 — 3 PHASE — 4 WIRE — EXTG TYPE
MOUNTING: SURFACE — 150 AMP — MAIN CIRCUIT BREAKER — 10,000 AIC

LOAD KVA	LOAD SERVED	WIRE	TRIP	FRAME (Note 1)	CKT NO	A B C	CKT NO	FRAME (Note 1)	TRIP	WIRE	LOAD SERVED	LOAD KVA
0.70	CORRIDOR REC (EXISTING)	EX	20		1		2		20	EX	CAF REC (EXISTING)	1.20
1.00	E.W.C (EXISTING)	EX	20		3		4		20	EX	CAF REC (EXISTING)	1.50
0.20	FC-3 (EXISTING)	EX	15		5		6		20	EX	HVAC CONTROL (EXISTING)	0.50
0.70	RECIRC PUMP (EXISTING)	EX	20		7		8		20	EX	F-3 KIT TOILET (EXISTING)	0.70
2.20	WH (EXISTING)	EX	30		9		10		20		SPARE	0.00
2.20					11		12		20	EX	DEF-1 (EXISTING)	0.40
0.60	ELEC ROOM EX FAN (EXISTING)	EX	20		13		14		20	EX	HP-1 KIT OFFICE (EXISTING)	0.70
0.00	SPACE ONLY				15		16			EX		0.70
0.00	SPACE ONLY				17		18		20		SPARE	0.00
0.00	SPACE ONLY				19		20				SPACE ONLY	0.00
0.00	SPACE ONLY				21		22				SPACE ONLY	0.00
0.00	SPACE ONLY				23		24				SPACE ONLY	0.00
0.00	SPACE ONLY				25		26				SPACE ONLY	0.00
0.00	SPACE ONLY				27		28				SPACE ONLY	0.00
0.00	SPACE ONLY				29		30				SPACE ONLY	0.00
0.00	SPACE ONLY				31		32				SPACE ONLY	0.00
0.00	SPACE ONLY				33		34				SPACE ONLY	0.00
0.00	SPACE ONLY				35		36				SPACE ONLY	0.00
0.00	SPACE ONLY				37		38				SPACE ONLY	0.00
0.00	SPACE ONLY				39		40				SPACE ONLY	0.00
0.00	SPACE ONLY				41		42				SPACE ONLY	0.00
7.6						SUB-TOTALS						5.7

	LOAD (KVA)	Conn.	D.F.	Dmd	TOTAL LOAD PER PHASE:		
	LIGHTS	0.0	1.25	0.0	CONNECTED		
	HEATING	0.0	1.00	0.0	A =	4.6 KVA	38.3 A
	COOLING	0.0	1.00	0.0	B =	5.4 KVA	45.0 A
	VENTILATION	0.6	1.00	0.6	C =	3.3 KVA	27.5 A
	MOTORS	0.0	1.00	0.0	DEMAND		
	KITCHEN	0.0	0.65	0.0	A =	4.6 KVA	38.3 A
	REC. (1st 10kVA)	3.4	1.00	3.4	B =	5.4 KVA	45.0 A
	REC. (>10kVA)	0.0	0.50	0.0	C =	3.3 KVA	27.5 A
	WATER HEATER	4.4	1.00	4.4	DEMAND @ 125%		
	MISC.	4.9	1.00	4.9	A =	5.8 KVA	47.9 A
	SPARE	0.0	1.00	0.0	B =	6.8 KVA	56.2 A
	TOTAL (KVA)	13.3		13.3	C =	4.1 KVA	34.3 A

NOTES:
1. PANEL & BREAKER ARE EXISTING TO REMAIN. NO NEW WORK.
2. TURN OFF ALL UNUSED/SPARE CIRCUIT BREAKERS.



MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN
1927 S. TRYON ST., SUITE 300, CHARLOTTE NC

MECHANICAL LEGEND

SYMBOL	DESCRIPTION	ABBR.
DTS	EX DUAL TEMP WATER SUPPLY	DTS
DTR	EX DUAL TEMP WATER RETURN	DTR
G	NATURAL GAS PIPING	G
D	CONDENSATE DRAIN	D
	GAS COCK	
	PRESSURE REDUCING/REGULATING VALVE	
	SOLENOID VALVE	
T	THERMOSTAT / TEMP SENSOR (4'-0" AFF TO TOP)	
H	HUMIDISTAT (4'-0" AFF TO TOP)	
C02	C02 DETECTOR (4'-0" AFF TO TOP)	
	SUPPLY AIR DIFFUSER (4-WAY)	
	RETURN AIR GRILLE	
	DOUBLE LINE DUCTWORK	
	SINGLE LINE DUCTWORK	
	EXISTING DOUBLE LINE DUCTWORK	
	EXISTING SINGLE LINE DUCTWORK	
	EXISTING DUCTWORK TO BE REMOVED	
20/14ø	20"x14" FLAT OVAL DUCT	
20x14	20"x14" RECTANGULAR DUCT	
8"ø	8" DIAMETER ROUND DUCT	
DD	DUCT MOUNTED SMOKE DETECTOR W/ ACCESS DOOR	
	POINT OF EXISTING TO NEW CONNECTION	
	POINT OF DEMOLITION TO EXISTING	
M.C.	MECHANICAL CONTRACTOR	
E.C.	ELECTRICAL CONTRACTOR	
P.C.	PLUMBING CONTRACTOR	
N.I.C.	NOT IN CONTRACT	
EX	EXISTING	
AFF	ABOVE FINISHED FLOOR	
DN	DOWN	
UP	UP	

COMMISSIONING NOTE - 2018 NCECC C408

UNION COUNTY PUBLIC SCHOOLS WILL PROVIDE A THIRD PARTY COMMISSIONING AGENT, RESPONSIBLE FOR SYSTEM COMMISSIONING PER 2018 NCECC SECTION C408. TO PERFORM THE COMMISSIONING DUTIES DESCRIBED IN SECTION C408, AND PROVIDE THE OWNER AND CODE OFFICIAL WITH A SEALED STATEMENT OF COMPLETION (APPENDIX C1). THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH COMMISSIONING AGENT AND PROVIDE ALL NECESSARY TIME, MATERIALS, AND PROCEDURES REQUIRED FOR A FULLY COMMISSIONED PROJECT.

DRAWING LIST

2018 NORTH CAROLINA ENERGY CONSERVATION CODE

COMMERCIAL ENERGY EFFICIENCY - MECHANICAL SUMMARY

C401 METHOD OF COMPLIANCE

- ■ 2018 NCECC CHAPTER 4
- ☐ ASHRAE 90.1-2013 PRESCRIPTIVE
- ☐ ASHRAE 90.1-2013 PERFORMANCE
- ☐ N/A (EXISTING LIGHTING, HVAC, AND DOM. WATER HEATING SYSTEMS TO REMAIN)
- ☐ COMCHECK PROVIDED (2018 NCECC)
- ☐ COMCHECK PROVIDED (90.1-2013)
- ☐ ENERGY MODELING DATA PROVIDED

C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

- ☐ C406.2 EFFICIENT MECH EQUIPMENT
- ☐ C406.3 REDUCED LTG DENSITY
- ☐ C406.4 ENHANCED LTG CONTROLS
- ☐ C406.5 ON-SITE RENEWABLE ENERGY
- ☐ C406.6 DEDICATED OA SYSTEM
- ☐ C406.7 SERVICE WATER HEATING
- ■ N/A EQUIPMENT REPLACEMENT ONLY (RTU-1,2,5,6, AHU-1)

C301 CLIMATE ZONE

3A - UNION COUNTY, NORTH CAROLINA

DESIGN CONDITIONS

EXTERIOR (ASHRAE 90.1-2013 TABLE D-1)

winter dry bulb	18° F.
summer dry bulb	91° F.
summer wet bulb	74° F.

INTERIOR (2018 NCECC SECTION C302.1)

winter dry bulb	72° F.
summer dry bulb	75° F.

C403.2 HEATING & COOLING LOADS AND EQUIPMENT & SYSTEM SIZING

BUILDING HEATING LOAD	EXISTING
BUILDING COOLING LOAD	EXISTING
INSTALLED HEATING CAPACITY	REFER TO SCHEDULES
INSTALLED COOLING CAPACITY	REFER TO SCHEDULES

C403.2.3 & C406.2 - REQUIRED & INCREASED HVAC EQUIPMENT PERFORMANCE

SYSTEM DESCRIPTION - REPLACEMENT OF EXISTING ROOFTOP UNITS WITH GAS/DX ROOFTOPS (TYPICAL OF 5) SEE SCHEDULES

- ■ MINIMUM HVAC EQUIP EFFICIENCY COMPLIANCE - TABLE C403.2.3
- ☐ INCREASED HVAC EQUIP EFFICIENCY COMPLIANCE - 10% OVER TABLE C403.2.3

EQUIP TYPE	SIZE CATEGORY (BTUH)	SUBCATEGORY	C403.2.3 MINIMUM EFFICIENCY (a)	10% INCREASED EFF. (a)	DESIGN EFFIC.
TABLE C403.2.3(1) - UNITARY AIR CONDITIONERS AND CONDENSING UNITS					
AIR COND, AIR COOLED	>= 65,000 & < 135,000	SPLIT SYSTEM & SINGLE PACKAGE	11.2 EER 12.8 IEER	12.3 EER 14.1 IEER	SEE SCHEDULE

a. DEDUCT 0.2 FROM THE REQUIRED EERS AND IEERS FOR UNITS WITH A HEATING SECTION OTHER THAN ELECTRIC RESISTANCE HEAT OR NO HEAT.

C403.2.4 THRU C403.2.11

■ HVAC SYSTEMS ARE FULLY COMPLIANT WITH THE REQUIREMENTS FOR HVAC SYSTEM CONTROL, VENTILATION, ENERGY RECOVERY, DUCT AND PLENUM INSULATION AND SEALING, PIPING INSULATION, AND SYSTEM COMPLETION.

C403.2.12 - AIR SYSTEM DESIGN AND CONTROL

- ☐ ALL FANS INSTALLED ON THE PROJECT ARE 5 HP OR LESS AND ARE EXEMPT FROM THESE REQUIREMENTS.
- ■ FANS ABOVE 5 HP MEET THE CFM LIMITATIONS SHOWN BELOW:

OPTION 1 - FAN SYSTEM MOTOR NAMEPLATE HP - TABLE C403.2.12.1(1)

ALLOWABLE NAMEPLATE MOTOR HP	CONSTANT VOLUME MINIMUM CFM	VARIABLE VOLUME MINIMUM CFM	DESIGN CFM
10	9,091 CFM	6,667 CFM	SEE SCHEDULE

C403.3 - ECONOMIZERS (PRESCRIPTIVE)

- ■ PROJECT INCLUDES AN AIR OR WATER ECONOMIZER COMPLIANT WITH C403.3
- ☐ PROJECT MEETS AN ECONOMIZER EXCEPTION LISTED IN C403.3

C403.4 - HYDRONIC AND MULTIPLE-ZONE HVAC SYSTEMS CONTROL AND EQUIPMENT (PRESCRIPTIVE)

- ■ PROJECT CONSISTS OF ONLY SINGLE ZONE DX SYSTEMS, EXEMPT FROM THE PRESCRIPTIVE REQUIREMENTS OF C403.4.
- ☐ PROJECT CONSISTS OF HVAC SYSTEMS FULLY COMPLIANT WITH THE PRESCRIPTIVE REQUIREMENTS OF C403.4.

C405.8 - ELECTRICAL MOTORS (MANDATORY REQUIREMENTS).

- ■ ELECTRICAL MOTORS HAVE BEEN SPECIFIED TO MEET MINIMUM EFFICIENCY REQUIREMNTS PER C405.8, EXCEPT WHERE EXEMPT.
- ☐ NOT APPLICABLE.

C408 - SYSTEM COMMISSIONING

- ☐ BUILDING IS LESS THAN 10,000 SQUARE FEET AND IS EXEMPT FROM THE SYSTEM COMMISSIONING REQUIREMENTS OF SECTION C408.
- ■ BUILDING IS GREATER THAN 10,000 SQUARE FEET AND REQUIRES SYSTEM COMMISSIONING PER SECTION C408.

EQUIVALENT MANUFACTURERS LISTING

LISTING OF MANUFACTURER'S NAME DOES NOT GUARANTEE APPROVAL. ALL EQUIPMENT MUST MEET OR EXCEED QUALITY AND CAPACITIES OF SPECIFIED EQUIPMENT. FINAL APPROVAL WILL BE BASED ON EQUIPMENT SUBMITTALS. ANY MANUFACTURER NOT LISTED BUT WISHING TO BID THIS PROJECT SHALL SUBMIT A WRITTEN REQUEST A MINIMUM OF 7 DAYS PRIOR TO BID DATE OR AS INDICATED IN THE SPECIFICATIONS, PRIOR APPROVAL IS REQUIRED FOR ALL MANUFACTURERS NOT LISTED.

(ALPHABETICAL ORDER)

PACKAGED ROOFTOP UNITS (UNDER 25 TONS): CARRIER, TRANE, DAIKIN

AIR DISTRIBUTION: CARNES, METAL*AIRE, NAILOR, PRICE, TITUS, KRUEGER

DDC CONTROLS: EXISTING FRONT END: TRIDIUM
NEW JACE: N4 TRIDIUM
NEW CONTROLLERS: VANGUARD 32 (BACNET OVER IP)

VAV TERMINAL UNITS: CARRIER, ENVIRO-TEC, NAILOR, PRICE, TITUS, TRANE

NOTE:
ALL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.

VENTILATION CALCULATIONS (NCMC 2018, SECT 403):

OCCUPANCY CLASSIFICATION	PEOPLE O/A RATE IN BREATHING ZONE (CFM/PERSON)	AREA O/A RATE IN BREATHING ZONE (CFM/SQ. FT.)	DEFAULT OCCUPANCY DENSITY (PEOPLE/1000 SQ. FT.)	AREA (SQ. FT.)	CALCULATED OCCUPANCY (PEOPLE)	CALCULATED PEOPLE O/A (CFM)	CALCULATED AREA O/A (CFM)
CLASSROOMS (AGES 5-8)	7.500000	0.000000	25	2,100	53	394	0
			BLDG TOTAL OUTSIDE AIR REQ'D (Ez=0.8, CFM)			492	
			BUILDING TOTAL OUTSIDE AIR PROVIDED (CFM)			RTU-7 = 500CFM	

MECHANICAL GENERAL NOTES

SEE SPECIFICATIONS FOR ADDITIONAL PROJECT REQUIREMENTS. THESE GENERAL NOTES ARE INTENDED TO SUPPLEMENT THE SPECIFICATIONS. IN THE EVENT THAT THE VERBIAGE IS IN CONFLICT OR CONTRADICTS THE REQUIREMENTS LISTED HERE, THE QUESTION SHALL BE ASKED PRIOR TO BIDDING OR THE MORE STRINGENT SHALL APPLY AT THE ENGINEER'S DISCRETION.

1. DO NOT SCALE DRAWINGS. SEE ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATION OF DOORS, WINDOWS, CEILING DIFFUSERS, ETC.
2. ALL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. THIS INCLUDES ANY MODIFICATIONS TO ANY ASSOCIATED MECHANICAL, PLUMBING, OR ELECTRICAL SYSTEMS REQUIRED BY THIS SPECIFIC MANUFACTURER'S INSTALLATION INSTRUCTIONS.
3. ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL CONSTRUCTED IN ACCORDANCE WITH THE LATEST SMACNA STANDARDS. ALL SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK SHALL INSULATED AS PER SPECIFICATIONS
4. ALL DUCTWORK SHALL BE SEALED PER THE REQUIREMENTS OF THE **NORTH CAROLINA** INTERNATIONAL MECHANICAL CODE. REFER TO MECHANICAL SPECIFICATIONS.
5. ALL PIPING, DUCTS, VENTS, ETC., EXTENDING THROUGH WALLS AND ROOF SHALL BE FLASHED AND COUNTERFLASHED IN A WATERPROOF MANNER.
6. ALL PIPING AND DUCTWORK LOCATIONS SHALL BE COORDINATED WITH THE WORK UNDER OTHER DIVISIONS OF THE SPECIFICATIONS, TO AVOID INTERFERENCE.
7. UPON PROJECT COMPLETION, THE MECHANICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE OWNER INSTALLATION INFORMATION INCLUDING RECORD SUBMITTALS (WITH ANY SUBMITTAL REVIEW COMMENTS ADDRESSED) AND O&M MANUALS FOR EACH PIECE OF EQUIPMENT INCLUDING ALL SELECTED OPTIONS, THE NAME AND ADDRESS OF AT LEAST ONE SERVICE AGENCY, FULL CONTROL SYSTEM O&M AND CALIBRATION INFORMATION INCLUDING WIRING DIAGRAMS, SCHEMATICS, FULL SEQUENCE OF OPERATION, AND PROGRAMMED SETPOINTS.
8. PROVIDE A ONE YEAR WARRANTY FOR ALL WORK PERFORMED BEGINNING ON THE DAY THE SYSTEM IS COMPLETELY OPERATIONAL AND ACCEPTABLE BY THE OWNER.
9. PROVIDE MANUFACTURER'S RECOMMENDED CLEARANCES AROUND ALL EQUIPMENT FOR MAINTENANCE AND FILTER REMOVAL.
10. CONDENSATE DRAIN PIPING SHALL BE PROVIDED AS PER SPECIFICATIONS.
11. ANY DEVICE REQUIRING A THERMOSTAT FOR CONTROL SHALL BE FURNISHED WITH A THERMOSTAT WHETHER INDICATED ON THE DRAWINGS OR NOT.
12. INSTALL THE TOP OF ALL THERMOSTATS, SENSORS, AND SWITCHES AT 4'-0" (MAXIMUM) ABOVE FINISH FLOOR. COORDINATE EXACT THERMOSTAT LOCATION WITH OWNER PRIOR TO INSTALLATION.
13. CONTRACTOR SHALL VERIFY LOCATION OF ALL EXISTING TO BE DEMOLISHED ROOF PENETRATIONS (DUAL TEMP PIPING) WORK. PATCHING OF EXISTING ROOF PENETRATIONS MADE THROUGH EXISTING ROOF SYSTEMS SHALL BE VERIFIED WITH THE OWNER'S EXISTING ROOF WARRANTY PRIOR TO WORK.
14. EXISTING ROOF CURBS SHALL BE MEASURED AND VERIFIED THRU ROOFTOP UNIT VENDOR AND CONRACTOR. NEW CURB ADAPTORS SHALL BE FABRICATED TO MATE WITH EXISTING ROOF CURBS.
15. CONTRACTOR SHALL VERIFY ALL NEW ROOFTOP UNITS OUTSIDE AIR INTAKES MAINTAIN A MINIMUM OF 10'-0" FROM ANY EXISTING EXHAUST FANS OR FLUE.
16. REFER TO SPECIFICATIONS FOR GAS PIPING MATERIALS AND INSTALLATION.
17. REFER TO SPECIFICATIONS FOR DUAL TEMPERATURE PIPING INSULATION, PIPE MATERIALS, VALVING, ETC. .
18. ALL EQUIPMENT CONCRETE PAD SIZES FOR MECHANICAL EQUIPMENT SHALL BE CONFIRMED WITH APPROVED SHOP DRAWING SUBMITTALS AND ASSOCIATED UNIT MANUFACTURER ANCHOR LOCATIONS PRIOR TO FABRICATION/INSTALLATION. THE MECHANICAL AND PLUMBING CONTRACTORS SHALL COORDINATE THE EXACT LOCATION OF MECHANICAL EQUIPMENT HOUSEKEEPING PADS WITH THE FLOOR DRAIN LOCATIONS PRIOR TO INSTALLATION OF DRAINS AT EQUIPMENT/PAD LOCATIONS.
19. DUCTWORK AND PIPING PASSING THROUGH/ABOVE ELECTRICAL ROOMS SHALL BE CLOSELY COORDINATED WITH THE ELECTRICAL CONTRACTOR. DUCTWORK OR PIPING SHALL NOT BE LOCATED ABOVE ELECTRICAL PANELS.
20. EQUIPMENT OPERATED DURING CONSTRUCTION SHALL USE FILTERED MEDIA TO PREVENT CONSTRUCTION DEBRIS FROM ENTERING COILS, DUCTWORK SYSTEMS, AIR TERMINALS ETC. AT COMPLETION OF CONSTRUCTION, MECHANICAL CONTRACTOR SHALL CLEAN ALL SYSTEMS WITH ALL CONTROL DEVICES WIDE OPEN AND REMOVE ANY REMAINING DEBRIS PRIOR TO TEST AND BALANCING. MECHANICAL CONTRACTOR SHALL REPLACE ALL FILTRATION WITH NEW FILTERS AT COMPLETION OF CONSTRUCTION. ANY DUCTWORK, AIR TERMINALS, AND/OR OTHER EQUIPMENT UPSTREAM OF FILTRATION SHALL BE CLEANED THOROUGHLY OF CONSTRUCTION DEBRIS BEFORE HANDING OVER TO OWNER.
21. ALL MECHANICAL EQUIPMENT SHALL BE U.L. LISTED AND LABELED AS A COMPLETE PACKAGE, NOT THROUGH INDIVIDUAL COMPONENTS OR PARTS. PROVIDE REQUIRED 3RD PARTY FIELD UL LISTING SERVICES AS REQUIRED TO COMPLY.

MECHANICAL DEMOLITION NOTES

1. THE MECHANICAL CONTRACTOR SHALL VISIT SITE PRIOR TO BEGINNING WORK TO DETERMINE THE LEVEL OF DEMOLITION REQUIRED AND INCLUDE ALL NECESSARY PRICING IN THEIR BID.
2. IT IS THE MECHANICAL CONTRACTORS RESPONSIBILITY TO FIELD VERIFY ALL EXISTING DUCTWORK AND PIPING. ANY DISCREPANCIES BETWEEN EXISTING CONDITIONS AND MECHANICAL PLANS SHOULD BE BROUGHT TO THE ATTENTION OF THE MECHANICAL ENGINEER.
3. THE MECHANICAL CONTRACTOR SHALL FIELD VERIFY ALL EXISTING FIRE DAMPERS ARE LOCATED WHERE INDICATED ON DRAWINGS. ALL NEW AND EXISTING DUCTWORK PENETRATING NEW RATED WALLS SHALL BE PROVIDED WITH A 1½-HOUR (TYPE-B) FIRE DAMPER WHETHER INDICATED ON PLANS OR NOT.
4. M.C. SHALL VERIFY ALL EXISTING SUPPLY AND RETURN AIR DUCT TO REMAIN IS INSULATED WITH VAPOR BARRIER INTACT. IF EXISTING DUCT IS NOT INSULATED WITH EITHER DUCT LINER OR WRAP, M.C. SHALL PROVIDE 2" THICK DUCT WRAP WITH VAPOR BARRIER (MIN. R-VALUE OF 5.0).
5. FOR ALL EXISTING HVAC EQUIPMENT AND DUCTWORK NOTED TO REMAIN AND SERVING AREA OF RENOVATION, MECHANICAL CONTRACTOR SHALL INSPECT EQUIPMENT (AND ANY ASSOCIATED CONTROLS, VALVES, DAMPERS, ETC.) TO VERIFY PROPER WORKING ORDER. MECHANICAL CONTRACTOR TO SERVICE AND CLEAN EXISTING HVAC UNITS TO ENSURE DESIGN AIRFLOW AND COOLING/HEATING CAPACITIES ARE OBTAINED. ANY EQUIPMENT FOUND TO BE INOPERABLE OR SHORT OF DESIGN CAPACITIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROJECT COMPLETION. PROVIDE CLEAN FILTERS IN ALL UNITS AT COMPLETION OF PROJECT. DAMAGED DUCTWORK SHALL BE REPAIRED.

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN
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SEAL:

NORTH CAROLINA PROFESSIONAL SEAL 027892 ENGINEER STEVEN R. DALEY
11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL SCHEDULES, NOTES, SYMBOLS AND LEGEND

DWG #:
M0.1

SHEET NO: 1 OF 10

ROOFTOP UNIT SCHEDULE - (DX COOLING WITH GAS HEAT - RTU-1,2,5,6) (RTU-7 COOLING ONLY)

SYMBOL	CFM	NOMINAL TONNAGE	OUTSIDE AIR MINIMUM (CFM)	E.S.P.	COOLING CAPACITY TC (BTUH)	COOLING CAPACITY SHC (BTUH)	EFFICIENCY EER	EFFICIENCY IEER	HEATING CAPACITY INPUT (BTUH)	HEATING CAPACITY OUTPUT (BTUH)	EFFICIENCY AFUE	COMPRESSORS NO.	COMPRESSORS RLA	COMPRESSORS LRA	OFM QTY.	OFM FLA	IFM QTY	IFM HP	POWER EXH. (EA) QTY.	POWER SUPPLY HP	POWER SUPPLY FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP	POWER SUPPLY VOLTAGE	OPERATING WEIGHT	ACCESSORIES	SYSTEM TYPE	MANUFACTURER DAIKIN MODEL
RTU-1	3,500	10	875•/175••	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-2	3,500	10	875•/175••	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-3	EXISTING RTU TO REMAIN										EXISTING RTU TO REMAIN																EXISTING RTU TO REMAIN	
RTU-4	EXISTING RTU TO REMAIN										EXISTING RTU TO REMAIN																EXISTING RTU TO REMAIN	
RTU-5	2,500	7.5	625•/125••	1.0"	93,000	67,000	12.1	19.8	200,000	160,000	80%	2	SEE NOTE "B"		2	1.8	1	4.0	1	4.0	3.5	20	25	460V-3ø	2,182 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,R,S,T	SINGLE ZONE VAV	DPS007A
RTU-6	3,500	10	875•/175••	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-7	2,500	7.5	500•/125••	2.0"	93,000	67,000	12.1	19.8	N/A	N/A	N/A	2	SEE NOTE "B"		2	1.8	1	8.0	1	4.0	3.5	24	30	460V-3ø	2,071 LBS	A,B,C,D,E,F,G,H,J,K,N,O,P,R,S	DUCT PRESSURE CONTROL	DPS007A

COMPRESSOR NOTES:

A. COMPRESSOR #1: 4.5 AMPS; COMPRESSOR #2: 7.9 AMPS

B. COMPRESSOR #1: 5.4 AMPS; COMPRESSOR #2: 3.9 AMPS

NOTES:

1. COOLING CAPACITIES BASED ON 95° AMBIENT, 80/67 ENTERING AIR.
2. ALL UNITS SHALL BE AGA CERTIFIED, U.L. LABELED, AND ASHRAE 90.1 COMPLIANT.
3. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR, INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR. SMOKE DETECTOR SHALL BE INSTALLED IN THE RETURN DUCT BY THE MECHANICAL CONTRACTOR.
4. PRIMARY COOLING COIL DRAIN PAN SHALL BE PROVIDED WITH A FLOAT SWITCH BY UNIT MFR; ACTIVATION OF THE FLOAT SWITCH SHALL SHUT DOWN UNIT AND SEND AN ALARM TO THE CENTRAL BAS.
5. INTEGRATE INTO EXISTING BAS (REVISE SEQUENCE PER SHEET M004), PROVIDE DDC TEMP/HUMIDITY SENSORS TO REPLACE EXISTING THERMOSTATS AT SAME LOCATION (N/A RTU-7).

• DESIGN OUTSIDE AIRFLOW (CFM)
•• OCCUPIED MINIMUM OUTSIDE AIRFLOW (CFM), REFER TO CO2 CONTROL ON SEQUENCE OF OPERATIONS.

ION FILTER REQUIREMENTS:

PROVIDE RTU'S WITH AN ION FILTER AS MANUFACTURED BY GLOBAL PLASMA SOLUTIONS INDICATED BELOW
MODEL # GPS-FC48-AC 120V COMPATIBLE
INSTALL (1) FILTER PER 4,800 CFM

ION FILTER NOTES:

1. FILTER SHALL BE UL-2998 RATED.
2. PROVIDE WITH INTEGRAL BAS ALARM CONTACTS.
3. PROVIDE WITH WEATHER TIGHT ENCLOSURE.

ACCESSORIES:

A - ROOF CURB ADAPTOR (FIT NEW UNIT TO EX CURB)
B - PERMANENT METAL FILTER FRAMES WITH REPLACEABLE FILTERS
C - VARIABLE SPEED DIRECT DRIVE SUPPLY FAN
D - DUAL COMPRESSORS #1 INVERTER, #2 FIXED
E - COMPARATIVE ENTHALPY ECOMOMIZER
F - VERTICAL DRAW THROUGH
G - 2" PLEATED FILTERS (MERV-8 MINIMUM)
H - LOW AMBIENT CONTROLS
I - UNIT CASING CONSTRUCTED OF ZINC COATED GALVANIZED STEEL.
J - CO2 SENSOR FOR DEMAND LIMITING CONTROL (BY BAS)
K - INTERNAL VIBRATION ISOLATION
L - MODULATING GAS HEAT (5:1 TURNDOWN)
M - ON/OFF HOT GAS REHEAT
N - STAINLESS STEEL COOLING COIL DRAIN PAN
O - CONDENSER COIL HAIL GUARDS
P - SINGLE POINT ELECTRICAL CONNECTION
Q - CONVENIENCE OUTLET
R - POWER EXHAUST FAN
S - GPS BI-POLAR IONIZATION FILTER (SEE NOTE THIS PAGE)
T - PROVIDE NEW TEMPERATURE/HUMIDITY SPACE SENSOR LOCATE IN SAME LOCATION AS EXISTING, FIELD VERIFY

AIR HANDLING UNIT SCHEDULE - (DX COOLING WITH GAS HEAT, SINGLE ZONE VAV)

SYMBOL	CFM	NOMINAL TONNAGE	OUTSIDE AIR MINIMUM (CFM)	E.S.P.	COOLING CAPACITY TC (BTUH)	COOLING CAPACITY SHC (BTUH)	EFFICIENCY EER	EFFICIENCY IEER	HEATING CAPACITY INPUT (BTUH)	HEATING CAPACITY OUTPUT (BTUH)	EFFICIENCY AFUE	COMPRESSORS NO.	COMPRESSORS AMPS	OFM QTY.	OFM FLA	IFM QTY	IFM HP	POWER EXH. (EA) QTY.	POWER SUPPLY HP	POWER SUPPLY FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP	POWER SUPPLY VOLTAGE	OPERATING WEIGHT	ACCESSORIES	MANUFACTURER DAIKIN MODEL
AHU-1	8,000	20	1500•/400••	1.0"	265,000	205,000	10.1	18.6	450,000	360,000	80%	1	30.1	2	5.2	1	10.0	1	4.0	4.0	59.3	80	460V-3ø	3833 LBS	SEE BELOW	DPS020A

NOTES:

1. COOLING CAPACITIES BASED ON 95° AMBIENT, 80/67 ENTERING AIR.
2. ALL UNITS SHALL BE AGA CERTIFIED, U.L. LABELED, AND ASHRAE 90.1 COMPLIANT.
3. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR, INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR. SMOKE DETECTOR SHALL BE INSTALLED IN THE RETURN DUCT BY THE MECHANICAL CONTRACTOR.
4. PRIMARY COOLING COIL DRAIN PAN SHALL BE PROVIDED WITH A FLOAT SWITCH BY UNIT MFR; ACTIVATION OF THE FLOAT SWITCH SHALL SHUT DOWN UNIT AND SEND AN ALARM TO THE CENTRAL BAS.
5. INTEGRATE INTO EXISTING BAS (REVISE SEQUENCE PER SHEET M005), PROVIDE DDC THERMIDISTAT, REPLACE EXISTING THERMOSTATS AT SAME LOCATION.

• DESIGN OUTSIDE AIRFLOW (CFM)
•• OCCUPIED MINIMUM OUTSIDE AIRFLOW (CFM), REFER TO CO2 CONTROL ON SEQUENCE OF OPERATIONS.

ACCESSORIES:

A - PERMANENT METAL FILTER FRAMES WITH REPLACEABLE FILTERS
B - VARIABLE SPEED DIRECT DRIVE PLENUM SUPPLY FAN (SINGLE ZONE VAV)
C - MODULATING CONTROL WITH INVERTER COMPRESSOR
D - SIDE DISCHARGE/INTAKE
E - 2" PLEATED FILTERS (MERV-8 MINIMUM)
F - UNIT CASING CONSTRUCTED OF ZINC COATED GALVANIZED STEEL.
G - CO2 SENSOR FOR DEMAND LIMITING CONTROL (BY BAS)
H - INTERNAL VIBRATION ISOLATION
I - 4-STAGE GAS HEATING
J - ON/OFF HOT GAS REHEAT
K - STAINLESS STEEL COOLING COIL DRAIN PAN
L - CONDENSER COIL HAIL GUARDS
M - POWER EXHAUST FAN
N - COMPARATIVE ENTHALPY ECONOMIZER
O - LOW AMBIENT CONTROLS
P - CONVENIENCE OUTLET

VAV BOX SCHEDULE

SYMBOL	CFM MAXIMUM	CFM MINIMUM	HEATING CFM	RUNOUT SIZE	ELEC. HEAT (KW)	VOLTAGE/ø	PRICE SDV	REMARKS
V-1	1250	250	750	14"ø	10	460V/3ø	12	SEE BELOW
V-2	1250	250	750	14"ø	10	460V/3ø	12	SEE BELOW

NOTES:

1. MINIMUM INLET PRESSURE TO TERMINAL UNITS SHALL BE 0.75" W.G.
2. MAXIMUM PRESSURE DROP THROUGH TERMINAL UNITS SHALL BE 0.25" S.P.
3. FURNISH BOXES WITH: DDC CONTROLS, ACOUSTICAL LINING, FILTER AND FRAME, DDC TEMP SENSOR THERMOSTAT, CONTROL VOLTAGE TRANSFORMER, ELECTRIC HEAT, U.L. LABEL, ELECTRONIC DUCT SENSOR FOR MORNING WARM-UP.
4. ELECTRIC HEATER SHALL BE FURNISHED WITH DISCONNECT SWITCH, MAGNETIC CONTACTORS, AIRFLOW SWITCH, MANUAL RESET THERMAL CUTOUT.
5. PROVIDE SCR CONTROLLERS ON ALL BOXES (1 - 10 VDC).
6. DDC CONTROLS SHALL BE FURNISHED TO THE BOX MANUFACTURER BY THE CONTROLS VENDOR. BOX MANUFACTURER SHALL FACTORY MOUNT AND WIRE CONTROLS. INSTALLATION OF CONTROLS SHALL INCLUDE CONTROLS TRANSFORMER, FAN RELAY, HEAT RELAY, AIR FLOW PROBE, CONTROL COVER, AND ALL WIRING AND LABOR FOR A COMPLETE AND OPERATIONAL SYSTEM.

GRILLE AND DIFFUSER SCHEDULE

SYMBOL	SERVICE	CFM RANGE	FACE SIZE (•)	NECK SIZE	TYPE	OBD	PRICE
A	SUPPLY	250	24x24	12x12	LOUVERED	NO	SMD
B	RETURN	1000	24x24	22x22	FIXED BLADE	NO	530
C	RETURN	7500	NK + FACE	SEE DWGS	FIXED BLADE	YES	95

(•) - FOR DEVICES INSTALLED IN GYP CEILINGS, PROVIDE MINIMUM FACE SIZE FOR SPECIFIED NECK SIZE.

NOTES:

1. ALL CEILING AND WALL MOUNTED DEVICES SHALL BE FURNISHED WITH AN ENAMEL OFF-WHITE FINISH.
2. ALL DEVICES SHALL BE FURNISHED WITH FRAMES SUITABLE FOR TYPE OF INSTALLATION REQUIRED.
3. TYP-B AND C: 3/4" BLADE SPACING AT 45 DEGREE DEFLECTION. TYPE-C: FULLY WELDED, HEAVY DUTY STEEL CONSTUCTION (GYM APPLICATION)

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN
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150 FAYETTEVILLE ST., SUITE 520, RALEIGH, NC 27601
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NORTH CAROLINA LICENSE NUMBER C1519
optima engineering

SEAL:

NORTH CAROLINA PROFESSIONAL SEAL 027896 ENGINEER STEVEN R. DALEY
11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT
110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL SCHEDULES

DWG #:
M0.2

SHEET NO: 2 OF 10

INPUT/OUTPUT SUMMARY

SYSTEM, APPARATUS, OR AREA POINT DESCRIPTION	INPUTS: ANALOG: MEASURED: TEMPERATURE	PRESSURE	RH	AIR FLOW	WATER FLOW	VOLTZ	HERTZ	AMPS	WATTS	ANALOG: CALC.: ENTHALPY	RUN TIME	EFFICIENCY	INPUTS: BINARY: STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	POWER	OVER-RIDE	OUTPUTS: DIGITAL: OFF-ON	OFF-AUTO-ON	OPEN-CLOSE	OUTPUTS: ANALOG: DMPR. POS.	VALVE POS.	SETPOINT ADJ.	SPEED CONTROL	SYSTEM FEATURES: ALARMS: HI ANALOG	LO ANALOG	HI BINARY	LO BINARY	PROOF	PROGRAMS: TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	ENTHALPY OPT.	ENERGY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAIN. WK. ORD.	GENERAL: COLOR GRAPHIC	SUPPLEMENTAL NOTES
AHU-1, RTU-1,2,5,6 (SINGLE ZONE VAV)																																	X							X	
Supply Fan													X							X									X												
VFD on/off																				X																					
VFD Speed																								X																	
VFD Status													X																X												
Exhaust Fan													X							X									X												
Compressor													X							X									X												
Cooling Coil Disch. Temp	X																																							
Supply Temp	X																																						
Return Temp	X																																						
Mixed Air Temp	X																																						
OA Damper			X																					X																
RA Damper																								X																
Smoke Detector														X																										
Filters Status														X															X												
Over-ride																		X																						
Space RH		X																											X											
Return CO2 (AHU-1 IN SPACE)				X																									X											
Hot Gas Reheat Valve																				X				X																
Condensate Flow Switch			X																										X											
Space Temp	X																												X									X	X	
Gas Furnace													X												X																
RTU-7 (VAV)																																	X							X	
Supply Fan													X							X									X												
VFD on/off																				X																					
VFD Speed																								X																	
VFD Status													X																X												
Exhaust Fan													X							X									X												
Compressor													X							X									X												
Cooling Coil Disch. Temp	X																																							
Supply Temp	X																																						
Return Temp	X																																						
Mixed Air Temp	X																																						
OA Damper			X																					X																
RA Damper																								X																
Smoke Detector														X																										
Filters Status														X															X												
Over-ride																		X																						
Space RH		X																											X											
Return CO2				X																									X											
DP Sensor	X																																						
Condensate Flow Switch			X																										X									X		
VAV Box w/Electric Heat																																							X	
Volume Damper			X																					X																
Discharge Temp	X																																						
Over-ride																		X																						
Setpoint Adjust																								X																
Space Temp	X																												X									X	X	
Electric Heat													X												X																

GENERAL NOTE:
INPUT/OUTPUT SUMMARY IS A GENERAL LIST OF CONTROL POINTS REQUIRED FOR THE OPERATION OF THE MECHANICAL SYSTEM. IN ADDITION TO CONTROL POINTS INDICATED, THE CONTROLS CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADDITIONAL POINTS AS REQUIRED FOR OPERATION OF THE MECHANICAL SYSTEM AS SPECIFIED AND OUTLINED IN THE SEQUENCE OF OPERATION AND TO COMPLY WITH THE SPECIFICATIONS.

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CHECKED BY: SRD

SHEET TITLE:
MECHANICAL POINTS LIST

DWG #:
M0.3

SHEET NO: 3 OF 10

SEQUENCE OF OPERATION

A COMPLETE AND OPERATIONAL DDC CONTROL SYSTEM (BAS) SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS (SECTION 230900) AND AS INTENDED ON THESE PLANS. ALL CONTROL POINTS AND EQUIPMENT SEQUENCES OF OPERATION LISTED IN SPECIFICATION SECTION 230900 SHALL BE CONSIDERED IN ADDITION TO THOSE LISTED HERE. IN THE EVENT THAT THE VERBIAGE IS IN CONFLICT OR CONTRADICTS THE REQUIREMENTS LISTED HERE, THE QUESTION SHALL BE ASKED PRIOR TO BIDDING OR THE MORE STRINGENT SHALL APPLY. MECHANICAL CONTRACTOR SHALL COORDINATE ALL BAS INTEGRATION REQUIREMENTS WITH EQUIPMENT VENDORS AND CONTROLS CONTRACTOR PRIOR TO PURCHASING EQUIPMENT AND PROVIDE ALL EQUIPMENT WITH COMMUNICATION/INTERFACE CARDS AS REQUIRED FOR SYSTEM INTEGRATION.

EXISTING BUILDINGS – PROJECT DESCRIPTION

THIS PROJECT CONSISTS OF 6 DX/GAS UNIT CHANGEOUTS. THE EXISTING CAMPUS BAS IS TRIDIUM AX. ALL NEW BAS CONTROLS SHALL EXTEND OFF THIS EXISTING SYSTEM.

DX/GAS SINGLE ZONE VAV AIR HANDLING UNIT (AHU–1, RTU–1,2,5,6)

ROOFTOP UNITS SHALL BE STOPPED/STARTED ON A TIME OF DAY SCHEDULE THROUGH THE BAS. THIS SCHEDULE SHALL BE MODIFIED BY A START STOP OPTIMIZATION PROGRAM. UPON PROOF OF AIR FLOW THRU THE SUPPLY FAN, AS SENSED BY A RESPECTIVE CURRENT SENSING RELAY, THE NORMALLY CLOSED OUTSIDE AIR DAMPER SHALL BE ENABLED.

UNIT SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS. IN THE COOLING MODE CONTROL WILL MONITOR THE SPACE TEMP AND SPACE COOLING SETPOINT WITH A PI CONTROL ALGORITHM. AS SPACE TEMP DEVIATES FROM THE COOLING SETPOINT THE UNIT CONTROLLER WILL CALCULATE A DISCHARGE AIR COOLING SETPOINT THAT THE ECONOMIZER AND COMPRESSOR OUTPUTS WLL BE CONTROLLED TO MEET. THIS ACTIVE DISCHARGE AIR SETPOINT WILL BE CALCULATED BETWEEN THE SPACE SETPOINT AND A USER ADJUSTABLE MINIMUM. ONCE CONTROL DETERMINES THAT A DISCHARGE AIR TEMP EQUAL TO THE USER SELECTED MINIMUM IS REQUIRED TO MEET THE SPACE COOLING DEMAND, IF SPACE DEMAND CONTINUES TO INCREASE THE SUPPLY FAN SPEED SHALL INCREASE TO MEET DEMAND. IN THE HEATING MODE THE SUPPLY FAN SHALL MODULATE TO DESIGN AIRFLOW AND OPERATE AS CONSTANT VOLUME HEATING UNIT UNTIL SETPOINT IS SATISFIED. THE SUPPLY FAN VFD WILL BEGIN OPERATION AT 60% AND MODULATE BETWEEN 60% AND 100% AS NEEDED TO MAINTAIN THE SPACE TEMPERATURE WITHIN THE SPACE HEATING RESET WINDOW CREATED BY CONFIGURING A SPACE HEATING HIGH AND A SPACE HEATING LOW RESET SOURCE SETPOINT. UNIT EXHAUST FAN SHALL BE STARTED/STOPPED BASED ON THE ECONOMIZER EXHAUST FAN POSITION.

A TEMPERATURE SENSOR SHALL BE UTILIZED TO MAINTAIN SPACE TEMPERATURE. ON A RISE IN TEMPERATURE ABOVE SENSOR SETPOINT, DX COMPRESSORS SHALL STAGE AS REQUIRED TO MAINTAIN SETPOINT. AS THE TEMPERATURE SPACE FALLS BELOW SETPOINT, GAS HEAT SHALL BE ENERGIZED IN STAGES TO MAINTAIN SPACE TEMPERATURE. THE TEMPERATURE SENSOR SHALL BE PROVIDED WITH AN OVERRIDE FUNCTION THAT WILL PLACE THE SYSTEM IN THE OCCUPIED MODE FOR A PERIOD OF UP TO 2 HOURS.

DEMAND CONTROL VENTILATION:
OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. THE OUTSIDE AIR DAMPER AND RETURN DAMPERS SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 800 PPM TO DESIGN MAXIMUM AT 1200 PPM. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1500 PPM. SEE AHU SCHEDULE FOR MINIMUM AND DESIGN OUTSIDE AIR SETPOINTS.

AIRSIDE ECONOMIZER CYCLE:
INTERNAL UNIT CONTROLS SHALL OPERATE ENTHALPY ECONOMIZER WHEN OUTSIDE AIR ENTHALPY IS LOWER THAN RETURN AIR ENTHALPY. UNIT CONTROLS SHALL ALSO ACTIVATE POWER EXHAUST AS REQUIRED BASED ON BUILDING PRESSURE, TO MAINTAIN A MINIMUM OF +0.05" POSITIVE PRESSURE RELATIVE TO AMBIENT.

SMOKE DETECTION & AHU SHUTDOWN:
UPON DETECTION OF SMOKE IN THE AIR HANDLING SYSTEM BY THE DUCT–MOUNTED RETURN AIR SMOKE DETECTOR, AN ALARM CONDITION SHALL BE SENT TO THE BUILDING FIRE ALARM SYSTEM AND ALL AIR HANDLING UNITS SHALL BE SHUTDOWN BY THE BUILDING FIRE ALARM SYSTEM. THE BUILDING FIRE ALARM SYSTEM SHALL PROVIDE ONE DIGITAL OUTPUT TO THE BAS TO INDICATE ACTIVATION OR FAILURE OF ANY SMOKE DETECTOR.

HUMIDITY CONTROL
WITH SYSTEM IN OCCUPIED OR UNOCCUPIED MODE, HUMIDITY CONTROL SYSTEM SHALL BE CAPABLE OF BEING ACTIVATED. UNDER NORMAL OPERATION, UNIT SHALL BE CONTROLLED AS OUTLINED ABOVE. PROVIDE HUMIDISTAT AS INDICATED ON THE PLANS, IF SPACE HUMIDITY REACHES 60% R.H. (ADJ), ALARM SHALL BE SENT TO THE CENTRAL BAS AND HUMIDITY CONTROL SEQUENCE SHALL BE ACTIVATED. OUTSIDE AIR INTAKE SHALL CLOSE TO MINIMUM POSITION, UNIT COMPRESSORS SHALL ACTIVATE TO PROVIDE COOLING, RTU HOT GAS REHEAT SHALL TURN ON TO MAINTAIN SPACE TEMPERATURE SETPOINT. WHEN SPACE RELATIVE HUMIDITY DROPS BELOW 55% R.H. (ADJ), BAS SHALL DEACTIVATE HUMIDITY CONTROL SEQUENCE (DE–ENERGIZE REHEAT VALVE). CONTROL OF UNIT SHALL REVERT BACK AS INDICATED ABOVE

DX VAV AIR HANDLING UNIT WITH VAV BOXES (RTU–7)

AIR HANDLING UNITS SHALL BE STOPPED/STARTED ON A TIME OF DAY SCHEDULE THROUGH THE BAS. THIS SCHEDULE SHALL BE MODIFIED BY A START STOP OPTIMIZATION PROGRAM. UPON PROOF OF AIR FLOW THRU THE SUPPLY FAN, AS SENSED BY A RESPECTIVE CURRENT SENSING RELAY, THE NORMALLY CLOSED OUTSIDE AIR DAMPER SHALL BE ENABLED.

VAV (RTU–7):
UNIT SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS. FACTORY UNIT MOUNTED CONTROLS SHALL OPERATE UNIT AS OUTLINED BELOW. SUPPLY FAN SHALL OPERATE CONTINUOUSLY WHEN THE UNIT IS IN THE OCCUPIED MODE. SUPPLY FAN SPEED SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE AND DUCT MOUNTED STATIC PRESSURE SENSOR. THE STATIC PRESSURE SENSOR SETPOINT SHALL BE RESET USING A TRIM AND RESPOND ALGORITHM BASED ON ZONE AIR FLOW REQUIREMENTS FROM A LOW SETTING OF 0.75" (ADJ) TO A HIGH SETTING OF 1.25" (ADJ). ON A CALL FOR MORE AIRFLOW AT THE ZONE LEVEL AND THE SPACE TEMPERATURE ABOVE SETPOINT, THE SETPOINT SHALL BE RESET TO THE HIGHER VALUE. AS ZONE TEMPERATURE SETPOINT IS SATISFIED AND THE AIRFLOW DEMAND DECREASES, THE SETPOINT SHALL RESET TO THE LOWER VALUE.

A DISCHARGE AIR TEMPERATURE SENSOR SHALL CONTROL UNIT COOLING SYSTEMS TO MAINTAIN THE ROOFTOP UNIT SUPPLY AIR TEMPERATURE PER THE FOLLOWING SUPPLY AIR TEMPERATURE (SAT) RESET SCHEDULE:

SUPPLY AIR TEMPERATURE RESET:
55° SAT WITH AN O.A. TEMPERATURE OF 70 DEGREES (OR HIGHER)
65° F. SAT WITH AN O.A. TEMPERATURE OF 55 DEGREES (OR LOWER)

NOTES:
1. SAT SETPOINT SHALL VARY LINEARLY BETWEEN THE HIGH AND LOW SETPOINTS. ALL SETPOINTS SHALL BE ADJUSTABLE.
2. SUPPLY AIR TEMPERATURE RESET SHALL BE LIMITED TO 62° F. IF ANY ZONED SERVED HAS A CALL FOR COOLING.

DEMAND CONTROL VENTILATION:
OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. THE OUTSIDE AIR DAMPER AND RETURN DAMPERS SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 800 PPM TO DESIGN MAXIMUM AT 1200 PPM. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1500 PPM. SEE AHU SCHEDULE FOR MINIMUM AND DESIGN OUTSIDE AIR SETPOINTS.

AIRSIDE ECONOMIZER CYCLE:
ROOFTOP UNIT FACTORY MOUNTED CONTROLS SHALL PROVIDE ECONOMIZER OPERATION TO PROVIDE "FREE COOLING" WHEN OUTDOOR AIR CONDITIONS ALLOW. UPON BAS DETERMINATION THAT OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY IN COOLING MODE, THE OUTSIDE AIR AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN UNIT DISCHARGE AIR TEMPERATURE. IF "ECONOMIZER" CONTROL IS INSUFFICIENT TO MAINTAIN DISCHARGE AIR TEMPERATURE, THE UNIT COOLING CYCLE SHALL FUNCTION AS OUTLINED ABOVE. UPON A DROP IN DISCHARGE AIR TEMPERATURE BELOW SETPOINT, THE OUTSIDE AIR DAMPER SHALL MODULATE CLOSED UNTIL THE MINIMUM OUTSIDE AIR POSITION IS REACHED. WITH OUTSIDE AIR DAMPER AT MINIMUM POSITION AND A CONTINUED DROP IN UNIT SUPPLY AIR TEMPERATURE BELOW SETPOINT, LOCAL VAV BOXES HEATING CYCLE SHALL MODULATE AS REQUIRED TO MAINTAIN UNIT SUPPLY AIR TEMPERATURE PER THE SAT RESET SCHEDULE ABOVE.UNIT CONTROLS SHALL ALSO ACTIVATE POWER EXHAUST AS REQUIRED BASED ON BUILDING PRESSURE, TO MAINTAIN A MINIMUM OF +0.05" POSITIVE PRESSURE RELATIVE TO AMBIENT.

HUMIDITY CONTROL
WITH SYSTEM IN OCCUPIED OR UNOCCUPIED MODE, HUMIDITY CONTROL SYSTEM SHALL BE CAPABLE OF BEING ACTIVATED. UNDER NORMAL OPERATION, UNIT SHALL BE CONTROLLED AS OUTLINED ABOVE. PROVIDE HUMIDISTAT AS INDICATED ON THE PLANS, IF SPACE HUMIDITY REACHES 60% R.H. (ADJ), ALARM SHALL BE SENT TO THE CENTRAL BAS AND HUMIDITY CONTROL SEQUENCE SHALL BE ACTIVATED. OUTSIDE AIR INTAKE SHALL CLOSE TO MINIMUM POSITION FOR RTU. UNIT COMPRESSORS SHALL ACTIVATE TO PROVIDE COOLING, VAV BOX ELECTRIC REHEAT COILS SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE SETPOINT. WHEN SPACE RELATIVE HUMIDITY DROPS BELOW 55% R.H. (ADJ), BAS SHALL DEACTIVATE HUMIDITY CONTROL SEQUENCE (DE–ENERGIZE REHEAT VALVE). CONTROL OF UNIT SHALL REVERT BACK AS INDICATED ABOVE

VAV BOX W/ ELECTRIC REHEAT

THE VAV BOX SHALL HAVE SEPARATE MINIMUM CFM SETTINGS FOR HEATING AND COOLING OPERATION. REFERENCE VAV BOX SCHEDULE ON THE PLANS FOR CFM VALUES.

VAV BOX OCCUPIED MODE: A TEMPERATURE SENSOR SHALL BE UTILIZED TO MAINTAIN SPACE TEMPERATURE. ON RISE IN SPACE TEMPERATURE ABOVE SETPOINT, THE VOLUME DAMPER SHALL OPEN AS REQUIRED TO MAINTAIN SPACE TEMPERATURE. ON DROP IN SPACE TEMPERATURE BELOW SETPOINT, THE VOLUME DAMPER SHALL CLOSE AS REQUIRED TO MAINTAIN SETPOINT UNTIL THE MINIMUM DAMPER POSITION IS REACHED. UPON CONTINUED DROP IN SPACE TEMPERATURE BELOW SETPOINT, BOX SHALL RESET TO HEATING CFM, AND THE ELECTRIC COIL SHALL BE STAGED TO MAINTAIN SETPOINT.

VAV BOX UNOCCUPIED MODE: IN THE NIGHT SETBACK MODE, WHEN THE AHU IS ENERGIZED, THE VAV BOX SHALL OPERATE AT HEATING CFM AND STAGE THE REHEAT COIL TO MAINTAIN UNOCCUPIED SPACE HEATING SETPOINT UNTIL THE VAV AHU SYSTEM SPACE TEMPERATURE RISES ABOVE THE NIGHT SETBACK UNOCCUPIED HEATING SETPOINT.

START/STOP OPTIMIZATION

BAS SHALL PROVIDE START/STOP OPTIMIZATION (SSO) FOR ALL EQUIPMENT AND SYSTEMS. SSO SHALL BE CAPABLE OF LEARNING BUILDING THERMAL CHARACTERISTICS AND RESPOND TO VARIABLE CONDITIONS. SSO SHALL START/STOP CONTROLLED EQUIPMENT AS LATE AS POSSIBLE PRIOR TO OCCUPIED TIME PERIOD AND AS EARLY AS POSSIBLE PRIOR TO UNOCCUPIED TIME PERIOD. SSO SHALL BE CALCULATED BASED ON OUTDOOR AIR TEMPERATURE, ZONE TEMPERATURES, AND CONTROL SETPOINT/SETBACK TEMPERATURES.

THERMOSTATS & TEMPERATURE SENSORS

THERMOSTATS AND TEMPERATURE SENSORS SHALL BE PROVIDED WHERE INDICATED ON THE DRAWINGS, AND PER THE SPECIFICATIONS. THERMOSTATS IN OCCUPIED SPACES SHALL HAVE ROTARY SWITCH ADJUSTMENT WITH NUMERICAL INDICATION, INITIALLY SET IN THE OCCUPIED MODE FOR COOLING TO 75° AND HEATING TO 70°. THERMOSTATS SHALL HAVE A 3° RANGE IN WHICH THEY ARE SATISFIED (IF SET TO 70°, SATISFIED ANYWHERE BETWEEN 68.5° AND 71.5°). DIAL SHALL HAVE THE CAPABILITY TO ADJUST THE HEATING AND COOLING SETPOINTS BY 3° IN EITHER DIRECTION, BUT MAINTAIN A MINIMUM 4° SPREAD BETWEEN THE HEATING AND COOLING SETPOINT. THERMOSTATS IN DATA ROOMS, CORRIDORS, AND OTHER UNOCCUPIED AREAS SHALL BE FLAT PLATE SENSORS WITH NO LOCAL ADJUSTMENT CONTROL. UNOCCUPIED SETTINGS SHALL BE 80° COOLING AND 60° HEATING. ALL SETPOINTS SHALL BE VERIFIED WITH THE OWNER BEFORE PROGRAMMING, AND FULLY ADJUSTABLE THROUGH THE BAS.

NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. ALL CONTROL SETPOINTS SHALL BE ADJUSTABLE AND TRENDABLE BY THE USER WITHUT ASSISTANCE FROM THE CONTROLS MANUFACTURER. THIS SHALL BE COVERED AS PART OF TRAINING WITH OWNER, SCHOOL STAFF, AND MAINTENANCE DEPARTMENT. INDICATED SCHEDULES AND SETPOINTS SHOULD BE USED FOR ORIGINAL SYSTEM SET–UP. ANY CHANGES IN SETPOINT SETTINGS REQUIRED FOR INTENDED SYSTEM OPERATION SHALL BE APPROVED BY THE ENGINEER AND SHALL BE DISCREETLY INDICATED ON THE AS–BUILT DRAWINGS.
3. CURRENT SWITCHES SHALL BE PROVIDED IN THE PIPING OF EACH PUMP TO VERIFY PUMP STATUS.
4. PHOTOELECTRIC TYPE DUCT SMOKE DETECTORS WILL BE PROVIDED BY THE ELECTRICAL CONTRACTOR, INSTALLED IN THE DUCT BY THE MECHANICAL CONTRACTOR AND WIRED TO SHUT–DOWN THE UNIT BY THE ELECTRICAL CONTRACTOR.
5. ELECTRICAL CONTRACTOR SHALL PROVIDE A DEDICATED 120V CIRCUIT IN A J–BOX FOR CONTROL POWER. CONTROLS CONTRACTOR SHALL EXTEND 120V POWER FROM J–BOX TO CONTROL PANELS, DAMPER ACTUATORS, TRANSFORMERS, ETC. AS REQUIRED FOR INSTALLATION OF THEY CONTROL SYSTEM. ALL CONTROL TRANSFORMERS SHALL BE SEPARATELY INTERNALLY FUSED OR HAVE MANUAL RESETS.
6. BAS SHALL ALLOW GLOBAL OPERATION OF HOT WATER AND CHILLED WATER CONTROL VALVES, AND GLOBAL CONTROL OF THERMOSTAT SETPOINTS.
7. CONTROLS CONTRACTOR SHALL PROVIDE A MINIMUM OF 24 HOURS OF OWNER TRAINING PROVIDED BY A FACTORY CERTIFIED REPRESENTATIVE. COORDINATE THROUGH THE MECHANICAL CONTRACTOR AND CONSTRUCTION MANAGEMENT FIRM.
8. CONTROLS CONTRACTOR SHALL PROVIDE SPARE CONTROLLERS TO THE OWNER AT COMPLETION OF PROJECT. SPARE CONTROLLERS SHALL INCLUDE ONE AHU CONTROLLER, AND THREE VAV CONTROLLERS. FOUR SPARE TEMPERATURE SENSORS SHALL ALSO BE PROVIDED.
9. BAS SHALL HAVE POINT OF CONTROL ACCESS BY A LAP–TOP COMPUTER AT THE CONTROL PANEL IN EACH MECHANICAL ROOM. ACESSS SHALL BE INDEPENDENT OF OWNERS LAN.
10. ON A CALL FOR HEATING, ALL AIR HANDLING UNIT SUPPLY FANS SHALL BE LOCKED OUT UNTIL SECONDARY HOT WATER SUPPLY LOOP TEMPERATURE REACHES 85° F. (ADJ).
11. ALL BAS CONTROLLERS ON CHILLERS, BOILERS, PUMPS AND AIR HANDLING UNITS SHALL HAVE MANUAL "ON/OFF" OVERRIDE SWITCHES, EITHER ON THE CONTROLLER OR THE PANEL LOCATED IN THE ROOM. SOFTWARE OVERRIDE ONLY IS NOT ACCEPTABLE.
12. ALL CONTROL AND POWER WIRING SHALL BE PLENUM–RATED WITH A MINIMUM FIRE SPREAD RATING OF 25 AND A MINIMUM SMOKE DEVELOPED RATING OF 50 PER ASTM E84.
13. THE SEQUENCE OF OPERATION OF OPERATION AND POINTS LIST IS INTENDED TO COMMUNICATE THE MINIMUM REQUIREMENTS AND GENERAL DESIGN INTENT TO THE CONTROLS CONTRACTOR AND IS NOT INTENDED TO BE A FULLY DEVELOPED OR COMPLETE SEQUENCE OF OPEARTION. IN THE CONTROLS SUBMITTAL THE CONTROLS CONTRACTOR SHALL FULLY DEVELOP THE SEQUENCE OF OPERATIONS FOR ALL SYSTEMS IDENTIFIED AN SHALL PRESENT ALL SETPOINTS, CONTROL PARAMETERS, TIME DELAYS, ALARM POINTS, ETC. AS REQUIRED TO COMPLY WITH THE DESIGN INTENT. THE CONTROLS CONTRACTOR SHALL INCORPORATE STANDARD FEATURES SUCH AS MINIMUM RUN TIME DELAYS AND DEAD BANDS TO PREVENT SHORT CYCLING. ALL MONITORED POINTS SHALL INCLUDE EARLY HIGH/LOW ALARM NOTIFICATIONS PRIOR TO REQUIRED CORRECTIVE ACTIONS OR UNIT SHUT–DOWNS. CONTROL CONTRACTOR SHALL SPECIFY IN THE CONTROL SUBMITTAL FAIL SAFE POSITION FOR OUT OF RANGE, FAIL SAFE POSITIONING FOR OPEN CIRCUITS OR LOSS OF COMMUNICATION.
14. ALARMS THROUGH THE BAS SYSTEM SHALL BE VISIBLE ON THE INDIVIDUAL GRAPHICS THEMSELVES, NOT ONLY ON THE SUMMARY PAGE.

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DATE: 11-06-2023
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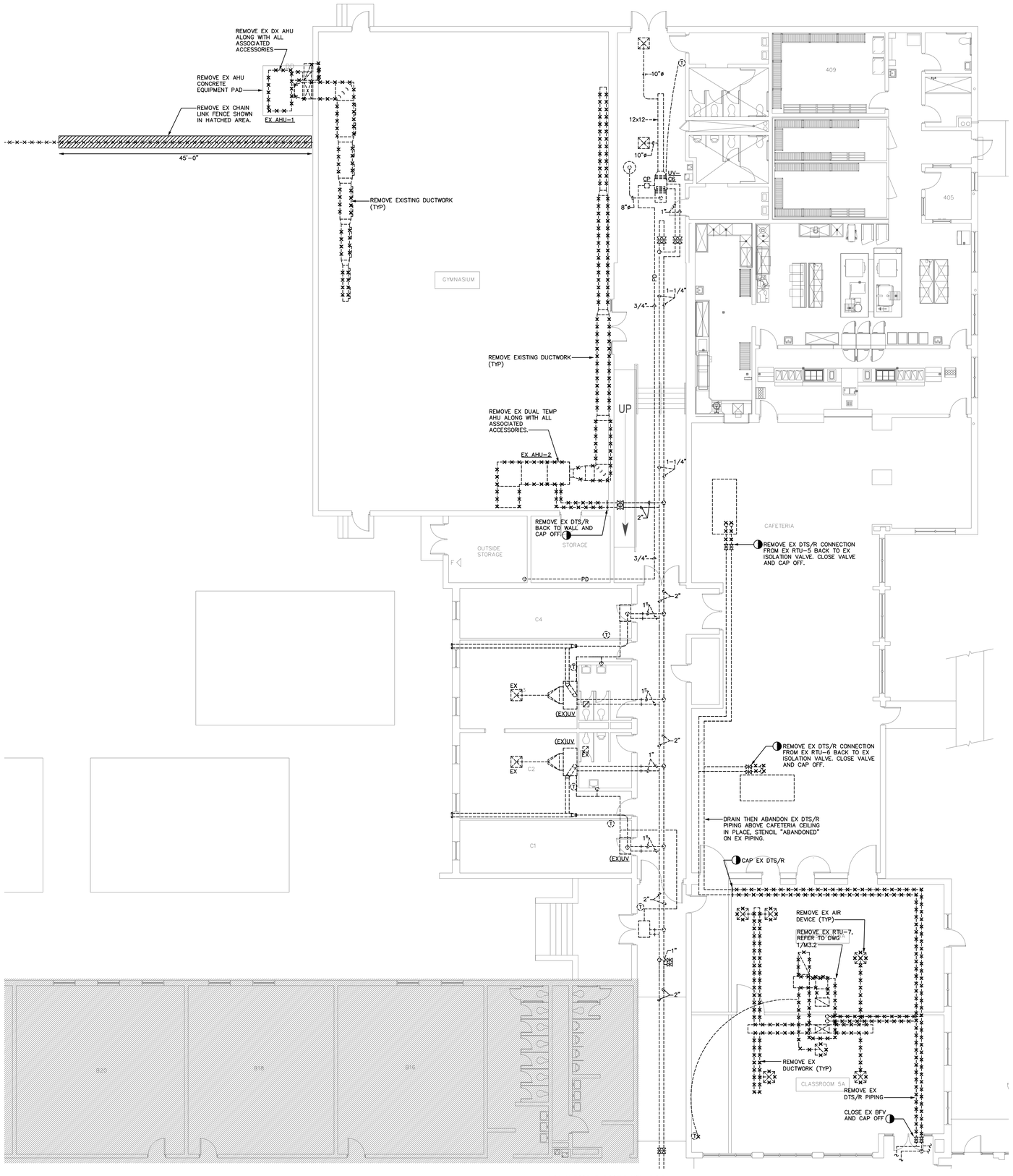
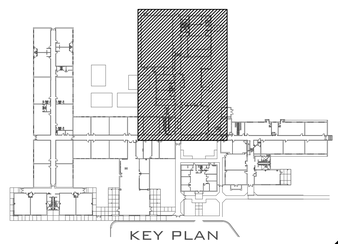
SHEET TITLE:
MECHANICAL SEQUENCE OF OPERATIONS

DWG #:
M0.4
SHEET NO: 4 OF 10



1 DEMOLITION PLAN
1/8" = 1'-0"



KEY PLAN

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

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SHEET TITLE:
MECHANICAL - DEMOLITION PLAN

DWG #:
M1.1

SHEET NO: 5 OF 10

SPILL CONDENSATE ONTO CONCRETE SPLASH BLOCK

SEAL ALL EXTERIOR WALL PENETRATIONS WEATHER TIGHT. ALL JOINTS AND SEAMS SEALED WITH EXTERIOR UV RATED DUCT SEALER.

PENETRATE WALL AT LOCATION OF EXISTING PENETRATION, CONTRACTOR TO FIELD VERIFY EXACT LOCATION AND SIZE.

24'-6"

INSTALL NEW FENCE, GALVANIZED STEEL CHAIN LINK TYPE FENCE, 6'-0" TALL, REFER TO SPECIFICATIONS

10'-0" WIDE SWING DOUBLE GATE

21'-0"

5'-0"

21'-6"

EXISTING | NEW

NEW CONCRETE PAD FOR NEW AHU, FIELD VERIFY

48"Wx36"Hx42"D RA PLENUM

24x30

AHU-1
20 TONS

6500-C (48x36)

20x38

PAINT EXPOSED GALVANIZED RECTANGULAR DUCT TO MATCH FABRIC DUCT SCHOOL COLORS. RECTANGULAR TRANSITION PIECES INSIDE GYM SHALL BE DOUBLE WALL TYPE DUCT. DUCT DIMENSIONS SHOWN ON PLAN ARE INSIDE CLEAR.

GALV. DUCT
FABRIC DUCT

38x20 SUPPLY AIR DUCT RISE UP ALONG EXTERIOR WALL AND PENETRATE WALL AT LOCATION OF EXISTING PENETRATION, CONTRACTOR TO FIELD VERIFY EXACT LOCATION AND SIZE.

PROVIDE INTERMEIDIATE DUCT SUPPORTS (TYP)

38/20s

38/20s

FABRIC SUPPLY DUCT SHALL BE ROUTED TIGHT TO UNDERSIDE OF WEB JOISTS. COLOR TO BE SELECTED BY OWNER. PROVIDE STENCILING FOR "WESLEY CHAPEL ELEMENTARY SCHOOL"

FABRIC DUCT
(SEE DETAIL 1/M4.2)

OVAL SHAPED FABRIC DUCTWORK

PERFORATED AIR DISTRIBUTION LOCATED ON BOTTOM AND RIGHT SIDE ONLY.

GYMNASIUM

TO AHU-1
PROVIDE PROTECTIVE CAGE GUARDS

CO2

UP

OUTSIDE STORAGE

STORAGE

CAFETERIA

C4

C2

C1

EX

(EX)UV

RTU ABOVE, REFER TO DWG 1/M3.2

DRAIN THEN ABANDON EX DTS/R PIPING ABOVE CAFETERIA CEILING IN PLACE, STENCIL "ABANDONED" ON EX PIPING.

TO RTU-7

RTU-7 ABOVE, REFER TO DWG 1/M3.2

1000-B

VAV-7-2

VAV-7-1

18x18 (LINED)

16x16

16x12

EQUIP CLEARANCE (TYP)

CLASSROOM 6A

CLASSROOM 5A

250-A

6X12

B15

1 MECHANICAL FLOOR PLAN
1/8" = 1'-0"

GAS PIPING DESIGN CRITERIA:
INITIAL GAS PRESSURE – LESS THAN 2.0 PSIG
GAS PRESSURE DROP –1.0 PSIG
TOTAL EQUIVALENT LENGTH OF PIPING – 500 FEET
PIPING SIZED PER NC FUEL GAS CODE
TABLE 402.4(3) SCHEDULE 40 METALLIC PIPE
EACH PIECE OF EQUIPMENT IS PROVIDED WITH A GAS PRESSURE REGULATOR.

GAS PIPING DN BELOW GRADE, RECONNECT

REPLACE EX GAS METER AT THIS LOCATION
NEW GAS LOAD = 1,250 CFH @ 2.0 PSIG
EXISTING GAS LOAD = 3,406 CFH (BOILERS)
EXISTING GAS LOAD = 7,960 CFH (DWH)
TOTAL GAS LOAD = 12,616 CFH

EX BOILER
1,703 CFH

EX BOILER
1,703 CFH

2 MECHANICAL FLOOR PLAN - GAS PIPING
1/8" = 1'-0"

KEY PLAN

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

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NORTH CAROLINA LICENSE NUMBER C-1914

SEAL:

NORTH CAROLINA PROFESSIONAL SEAL 027492 ENGINEER STEVEN R. DALEY
11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL FLOOR PLAN - NEW WORK

DWG #:
M2.1

SHEET NO: 6 OF 10

1 ROOF DEMOLITION PLAN
1/16" = 1'-0"

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

1927 S. TRYON ST., SUITE 300, CHARLOTTE NC 28203
150 FAYETTEVILLE ST., SUITE 520, RALEIGH, NC 27601
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NORTH CAROLINA LICENSE NUMBER C-1914

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SEAL:

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11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

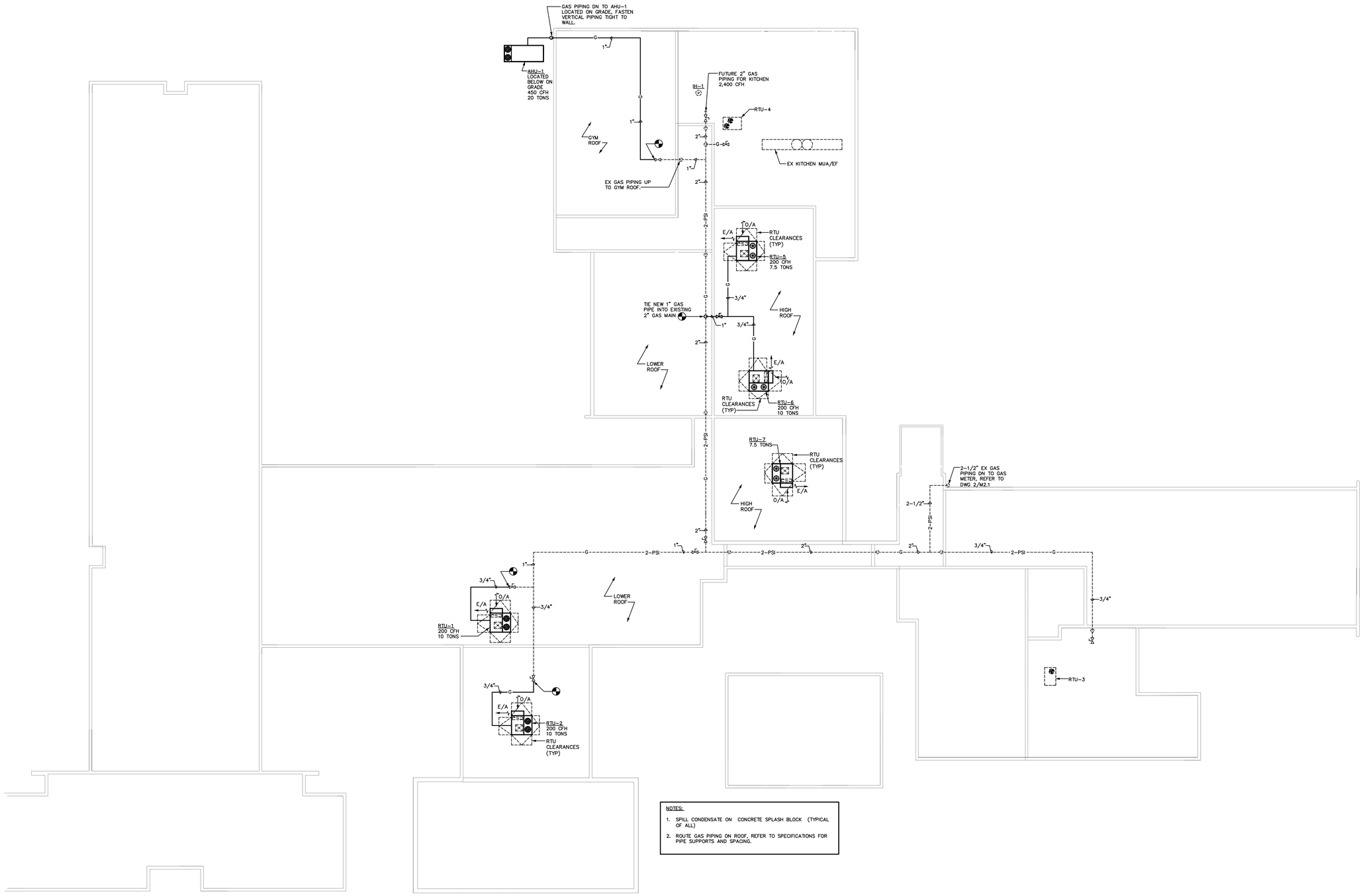
REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANCAL ROOF PLAN DEMOLITION

DWG #:
M3.1

SHEET NO: 7 OF 10



NOTES:

1. SPILL CONDENSATE ON CONCRETE SPLASH BLOCK (TYPICAL OF ALL)
2. ROUTE GAS PIPING ON ROOF, REFER TO SPECIFICATIONS FOR PIPE SUPPORTS AND SPACING.

1 MECHANICAL ROOF PLAN

1/16" = 1'-0"

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

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SEAL:

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11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

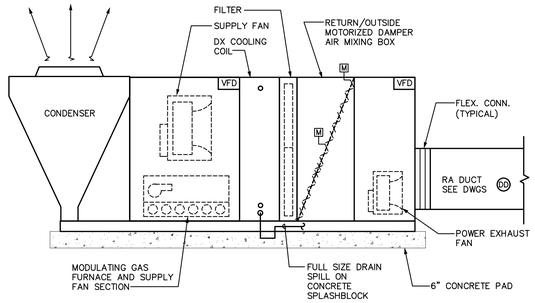
REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL ROOF PLAN NEW WORK

DWG #:
M3.2

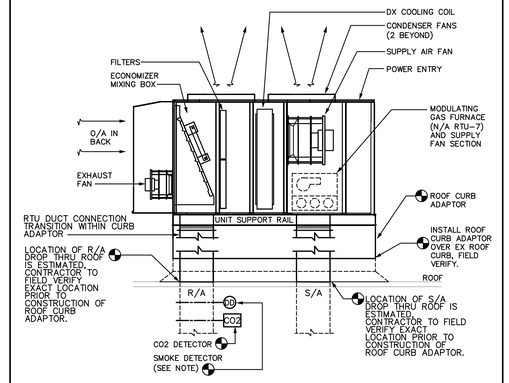
SHEET NO: 8 OF 10



NOTES:

1. ALL AIR HANDLING UNITS UNITS SHALL BE PROVIDED WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR MOUNTED IN THE RETURN DUCT. THE SMOKE DETECTOR SHALL BE FURNISHED AND WIRED FOR UNIT SHUT DOWN AND FIRE ALARM INTERFACE BY THE ELECTRICAL CONTRACTOR AND SHALL BE INSTALLED IN THE DUCT BY THE MECHANICAL CONTRACTOR.

1 AIR HANDLING UNIT (AHU-1)
NO SCALE



NOTES:

1. SEE PLANS FOR SIZE AND ROUTING OF DUCTWORK AND PIPING.
2. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR, INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR.SMOKE DETECTOR SHALL BE INSTALLED IN THE EXHAUST DUCT BY THE MECHANICAL CONTRACTOR.

2 ROOFTOP UNIT DETAIL (RTU-1,2,5,6,7)
NO SCALE

MECHANICAL • ELECTRICAL • PLUMBING
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11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT
110 POTTER ROAD
MONROE, NC 28110

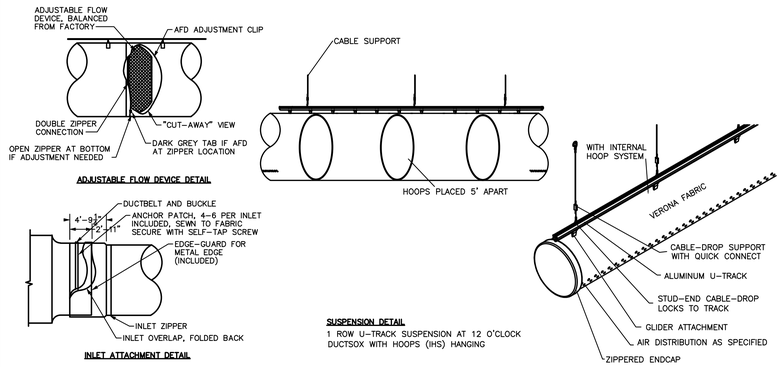
REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

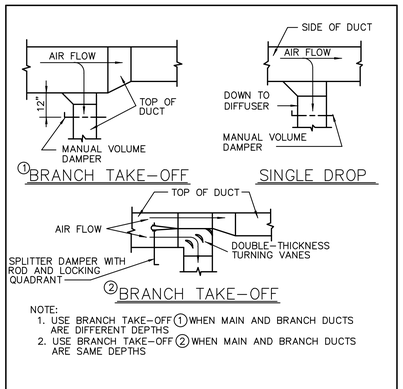
SHEET TITLE:
MECHANICAL EQUIPMENT DETAILS

DWG #:
M4.1

SHEET NO: 9 OF 10

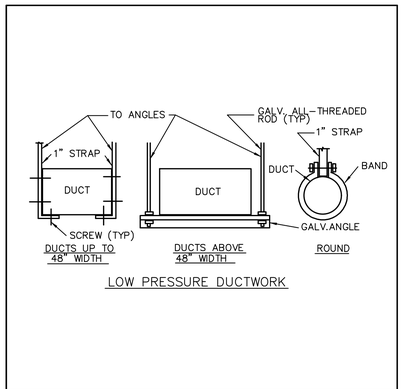


1 FABRIC DUCT DETAILS
NO SCALE



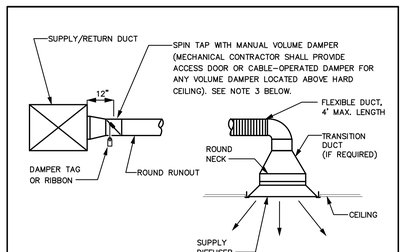
NOTE:
1. USE BRANCH TAKE-OFF (1) WHEN MAIN AND BRANCH DUCTS ARE DIFFERENT DEPTHS
2. USE BRANCH TAKE-OFF (2) WHEN MAIN AND BRANCH DUCTS ARE SAME DEPTHS

2 DUCTWORK DETAILS
NO SCALE



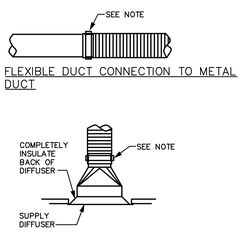
LOW PRESSURE DUCTWORK

3 DUCTWORK HANGER DETAILS
NO SCALE



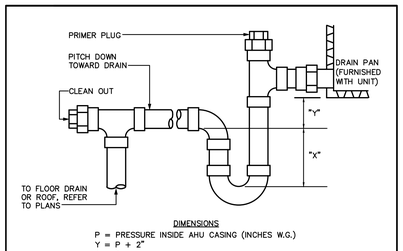
NOTE:
1. MANUAL VOLUME DAMPERS SHALL BE PROVIDED FOR ALL SUPPLY, RETURN AND GENERAL EXHAUST RUNOUTS.
2. ALL MANUAL VOLUME DAMPERS (FOR INSULATED DUCTWORK) SHALL BE PROVIDED WITH AN ELEVATED REGULATOR (STAND-OFF) EQUAL TO DURO DYNE SRST SERIES AND FULL-LENGTH SHAFT. STAND SHALL EXTEND A MINIMUM OF 2" BEYOND DUCTWORK WITH EXTENDED TAB/SHAFT.
3. CONTRACTOR TO COORDINATE WITH ARCHITECT FOR DESIRED DAMPER ACCESS STYLE. CABLE-OPERATED DAMPER ADJUSTMENT SHALL BE THROUGH AIR TERMINAL FACE OPERATION (CONCEALED MOUNTING) OR THROUGH CEILING-MOUNTED RECESSED PORTS EQUAL TO MAT RT-CCM.

4 SPIN TAP TO ROUND NECK DIFFUSER
NO SCALE



NOTE:
ALL FLEXIBLE DUCT CONNECTIONS TO SHEET METAL SHALL BE SECURED WITH APPROVED STRAP AND SEALANT.

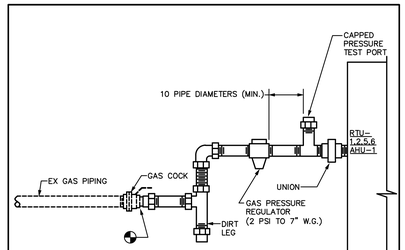
5 FLEX. CONNECTION DETAIL
NO SCALE



DIMENSIONS
P = PRESSURE INSIDE AHU CASING (INCHES W.G.)
Y = P + 2"
X = Y

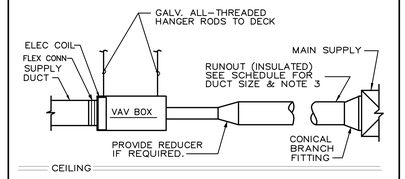
MINIMUM PIPE SIZE	MAXIMUM COIL LOAD (TONS)
3/4"	2
1"	5
1 1/4"	30
1 1/2"	50
2"	160
3"	300
4"	430
5"	1000

6 P-TRAP PIPING DETAIL
NO SCALE



NOTE:
1. PROVIDE DIELECTRIC UNIONS WHERE DISSIMILAR METALS ARE JOINED.
2. GAS PRESSURE REGULATORS INSTALLED WITHIN 15 FEET OF AN OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A VENT PIPE EXTENSION TO EXTEND A MINIMUM OF 3 FEET ABOVE THE OUTSIDE AIR INTAKE.

7. RTU-1,2,5,6 EQUIPMENT GAS CONNECTION DETAIL
NO SCALE



NOTES:
1. MECH. CONTR. INSTALL BOX WITHIN 18" OF CEILING AND PROVIDE ACCESS DOOR IN CEILING IF REQUIRED FOR BOX ACCESS.
2. PROVIDE MINIMUM OF FOUR DUCT DIAMETERS OF STRAIGHT DUCT PRIOR TO BOX (I.E. 24" STRAIGHT DUCT FOR 6" INLET), NO FLEX DUCT. PROVIDE FLEXIBLE CONNECTION AT BOX OUTLET.
3. PROVIDE 42" CLEAR SPACE IN FRONT OF CONTROLLER BOX FOR ACCESS.

9 VAV BOX DETAIL
NO SCALE

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NORTH CAROLINA LICENSE NUMBER C-1391-4
optima engineering

SEAL:

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT
110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL DETAILS

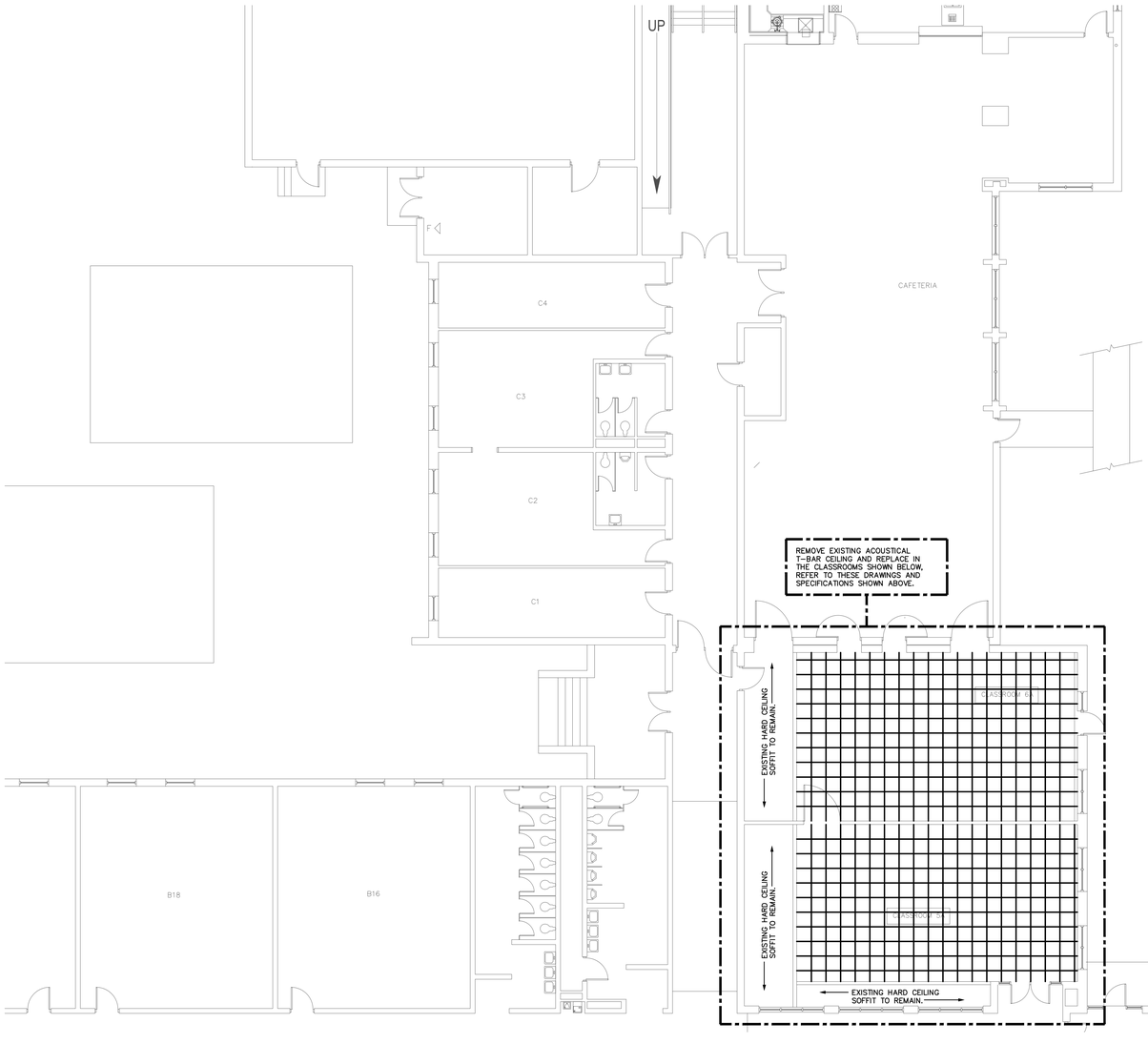
DWG #:
M4.2

SHEET NO: 10 OF 10

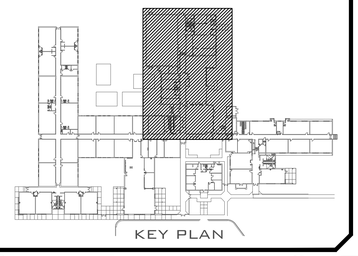
024119	Selective Demolition
General Demolition Notes	
1	TO THE EXTENTS INDICATED ON THE DOCUMENTS, REMOVE EXISTING CEILING TILE, SUSPENDED CEILING GRID, AND RELATED ACCESSORIES. NOTE EXISTING CEILING HEIGHT PRIOR TO DEMOLITION AS NEW SYSTEM TO BE REPLACED AT THAT SAME HEIGHT.
2	BEFORE PATCHING, VERIFY COMPATIBILITY WITH AND SUITABILITY OF SUBSTRATES, INCLUDING COMPATIBILITY WITH EXISTING FINISHES OR PRIMERS.
3	PROTECT EXISTING CONSTRUCTION DURING CUTTING AND PATCHING TO PREVENT DAMAGE. PROVIDE PROTECTION FROM ADVERSE WEATHER CONDITIONS FOR PORTIONS OF PROJECT THAT MIGHT BE EXPOSED DURING CUTTING AND PATCHING OPERATIONS.
4	PATCH WORK USING MATERIALS IDENTICAL TO EXISTING MATERIALS. FOR EXPOSED SURFACES, USE MATERIALS THAT VISUALLY MATCH EXISTING ADJACENT SURFACES TO THE FULLEST EXTENT POSSIBLE
5	REFER TO MECHANICAL AND ELECTRICAL FOR ADDITIONAL DEMOLITION NOTES

095113	Acoustical Panel Ceilings
Ceiling Panel	
Manufacturer:	ARMSTRONG (Basis-of-Design)
Style:	Cortega 770 - 2'x2'x5/8"
Color:	White
Pattern:	2'x2'x5/8" Square Lay-in
Subject to compliance with the project requirements, provide the named product above or a comparable product by one of the following manufacturers: • CertainTeed Fine Fissured HHF-157 • USG, Radar ClimaPlus 2210	
Suspension System	
Suspension System Components: Main beams and cross tees in accordance with the requirements of the local governing building code. Provide manufacturer required attachment devices, wire hangars and ties, wall mouldings, retaining clips, and other accessories as required.	
Manufacturer:	ARMSTRONG (Basis-of-Design)
Style:	15/16" Exposed Tee
Color:	Blizzard White
Structural Classification:	ASTM C 635-78 Heavy Duty
Installation:	ASTM C 636-76 Heavy Duty
Subject to compliance with the project requirements, provide the named product above or a comparable product by one of the following manufacturers: • CERTAINTEED • USG	
General Ceiling Notes	
1	INSTALL NEW ACOUSTICAL CEILING SYSTEM AT SAME HEIGHT OF EXISTING.
2	PATCH AND PAINT ALL INTERIOR GYPSUM WALL BOARD SURFACES WITHIN EXTENTS OF CONTRACTOR WORK AREA.
3	PATCH, REPAIR, OR REHANG EXISTING CEILINGS AS NECESSARY TO PROVIDE AN EVEN-PLANE SURFACE OF UNIFORM APPEARANCE.
4	SALVAGE EXISTING "STUDENT ART" CEILING TILE AND RETURN TO OWNER.
5	SEE ELECTRICAL DRAWINGS FOR LOCATION OF ALL EXISTING EMERGENCY LIGHTS, NIGHT LIGHTS, EXIT SIGNS, TELEVISION MONITORS, SMOKE DETECTORS, SPEAKERS, HORNS, AND STROBES.

099123	Interior Painting
Paint	
Manufacturer:	The Sherwin-Williams Co. (Basis-of-Design)
Product:	ProMar 200 Zero VOC
Color:	Match Existing
Primer:	Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
First and Second Coats:	Match existing, adjacent sheen or provide Semigloss if no adjacent finish is available for reference. Provide acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
Subject to compliance with the project requirements, provide the named product above or a comparable product by one of the following manufacturers: • Ultra Spec 500 Interior Latex Eggshell by Benjamin Moore & Co. • Speedhide Zero VOC by PPG Paints	
General Painting Notes	
1	WHERE PATCHING OCCURS IN A PAINTED SURFACE, APPLY PRIMER AND INTERMEDIATE PAINT COATS OVER THE PATCH AND APPLY FINAL PAINT COAT OVER ENTIRE UNBROKEN SURFACE CONTANING THE PATCH. PROVIDE ADDITIONAL COATS UNTIL PATCH BLENDS WITH ADJACENT SURFACES.



1 REFLECTED CEILING PLAN
1/8" = 1'-0"



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FIRE PROTECTION • TECHOLOGY DESIGN
1927 S. TRYON ST., SUITE 300, CHARLOTTE NC 28203
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SEAL:

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11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
REFLECTED CEILING PLAN - NEW WORK

DWG #:
R1.1
SHEET NO: 1 OF 1

GENERAL NOTES

1.0. CODES AND STANDARDS:

1.1. NORTH CAROLINA STATE BUILDING CODE 2018 EDITION INCLUDING ALL SUBSEQUENT SUPPLEMENTS AND AMENDMENTS THERETO.

1.2. "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES", AMERICAN SOCIETY OF CIVIL ENGINEERS, ASCE 7-10.

1.3. "SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS", PUBLICATION 360-10 BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, AND AS AMENDED IN SPECIFICATIONS.

1.4. "STRUCTURAL WELDING CODE - STEEL (AWS D1.1-10)" AND "STRUCTURAL WELDING CODE REINFORCING STEEL (AWS D1.4-11)", AMERICAN WELDING SOCIETY.

1.5. "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE (ACI 318-14)", AMERICAN CONCRETE INSTITUTE AND ALL SUCCEEDING REVISIONS.

1.6. "MANUAL OF STANDARD PRACTICE", CONCRETE REINFORCING STEEL INSTITUTE, LATEST EDITION.

2.0. STRUCTURAL STEEL:

2.1. ALL STRUCTURAL STEEL SHALL BE OF THE GRADES INDICATED BELOW, UNLESS NOTED OTHERWISE ON PLANS OR DETAILS:

A. OTHER ROLLED SHAPES ASTM A36 TYPICALLY, U.N.O.
B. ANCHOR BOLTS ASTM F1554 GR36 U.N.O.
C. PLATES AND BARS ASTM A36 U.N.O.
D. MISCELLANEOUS ASTM A36 U.N.O.

2.2. ALL STRUCTURAL STEEL SHALL BE DETAILED AND, FABRICATED IN ACCORDANCE WITH THE AISC CODE OF STANDARD PRACTICE AS MODIFIED IN THESE NOTES AND THE PROJECT SPECIFICATIONS.

2.3. SUBMIT SHOP DRAWINGS FOR DETAILS, FABRICATION, AND ERECTION OF STRUCTURAL STEEL. COMPLY WITH AISC "STEEL CONSTRUCTION MANUAL", AISC "DETAILING FOR STEEL CONSTRUCTION", AND AISC "ENGINEERING FOR STEEL CONSTRUCTION" PUBLICATIONS.

2.4. SHOP DRAWINGS SHALL BE REVIEWED BY THE CONTRACTOR PRIOR TO SUBMISSION. DRAWINGS SHALL BEAR THE CONTRACTOR'S APPROVAL STAMP ACCEPTING RESPONSIBILITY FOR DIMENSIONS, QUANTITIES AND COORDINATION WITH THE OTHER TRADES.

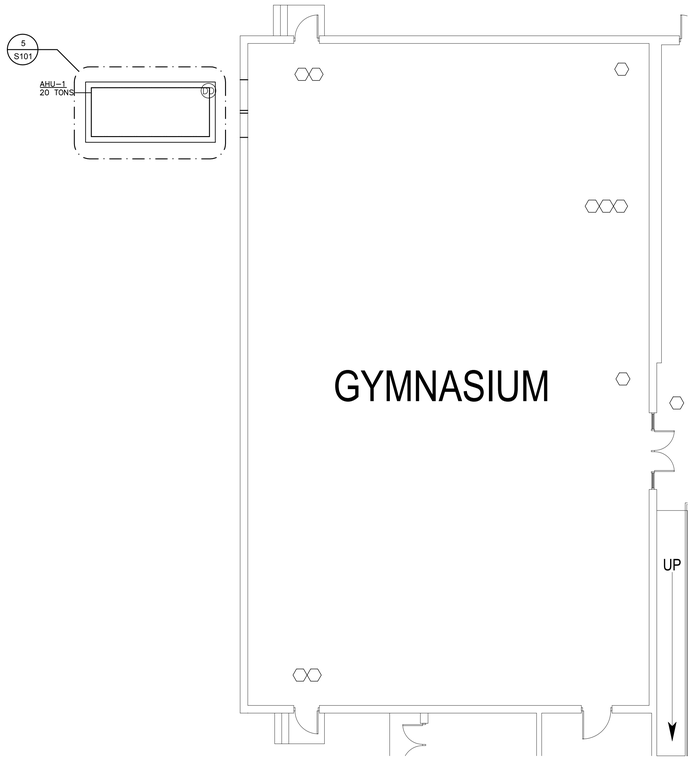
2.5. DRAWINGS MAY BE ELECTRONICALLY SUBMITTED, PROVIDED LEGIBILITY IS MAINTAINED. REVIEW COMMENTS ONLY WILL BE ELECTRONICALLY FORWARDED TO THE CONTRACTOR.

2.6. CONTRACTOR SHALL PROVIDE IN HIS SCHEDULE FOR A SHOP DRAWING REVIEW AND RETURN TIME OF A MINIMUM OF FIFTEEN (15) WORKING DAYS IN THE STRUCTURAL ENGINEER'S OFFICE.

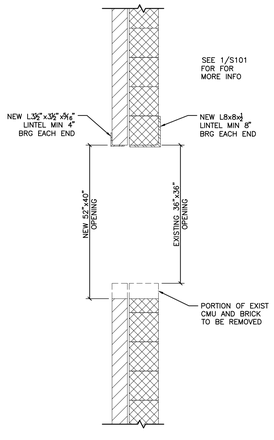
2.7. SPLICING OF STEEL MEMBERS, UNLESS SHOWN ON THE DRAWINGS, IS PROHIBITED WITHOUT WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER.

2.8. NO CHANGE IN SIZE OR POSITION OF ANY STRUCTURAL ELEMENT NOR HOLES, SLOTS, CUTS, ETC. SHALL BE MADE UNLESS DETAILED AND NOTED AS A PROPOSED CHANGE ON THE SHOP DRAWINGS AND REVIEWED AND ACCEPTED BY THE STRUCTURAL ENGINEER.

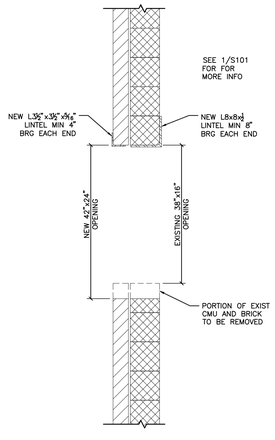
2.9 ALL EXPOSED STEEL TO BE HOT-DIPPED GALVANIZED.



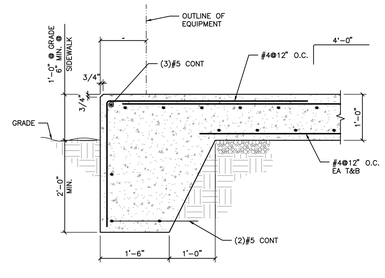
1 S101 SITE PLAN
1/8" = 1'-0"



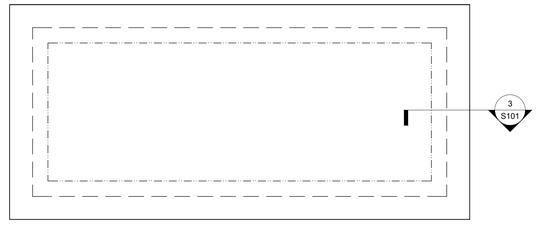
2 S101 SECTION @ UPPER OPNG
1/4" = 1'-0"



3 S101 SECTION @ LOWER OPNG
1/4" = 1'-0"



4 S101 SECTION
3/4" = 1'-0"



"REFERENCE MEP DRAWINGS FOR LOCATION OF EQUIPMENT AND EQUIPMENT INFORMATION."

5 S101 EQUIPMENT PAD
1/4" = 1'-0"

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHNOLOGY DESIGN
optima engineering
1927 S. Tryon St., Suite 300, Charlotte NC 28203
150 Fayetteville St., Suite 210, Raleigh, NC 27601
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SEAL: NC COA# C-1088

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15464 STEVEN RICKNER

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION

DATE: 11-06-2023
PROJECT #: 21-0271
DRAWN BY: RES
DESIGNED BY: MSR
CHECKED BY: MSR

SHEET TITLE:
STRUCTURAL PLAN AREA-A

DWG #:
S101

SHEET NO: OF

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: http://www.nc-sco.com

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

(1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

(8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

(10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ❑ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ❑ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ❑ **10** - **(20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($)_____.

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID# _____ Amount of Bid $ _____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

***Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

****** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires _____

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____

Name

_____

Title

_____

Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

EXHIBIT 3

DRAFT CONTRACT

DRAFT

AIA® Document A701™ – 2018

Instructions to Bidders

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

«Wesley Chapel Elementary School »
«110 Potter Road South »
«Monroe, NC 28110 »

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

«Union County Board of Education »« »
«400 N. Church Street »
«Monroe, NC 28112 »
« »

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

«Optima Engineering »« »
«1927 S Tryon Street »
«Suite 300 »
«Charlotte, NC 28203 »

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.

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.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of 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 any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

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

§ 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, to which Work may be added or deleted by 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, or that does not change, 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 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** 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 observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

« »

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper

documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 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.

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

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

« »

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

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

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

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

« »

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four 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 Prior to submitting a Bid, each Bidder shall ascertain 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 or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name 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.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

« »

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, 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. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning« »days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

« »

§ 4.3.2 Paper copies of the Bid, the bid security, 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.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

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

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

« »

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids
Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)
§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, 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 lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability
A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals
§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;
.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
.3 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 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder 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, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for 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.

§ 6.3.4 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

§ 7.1 Bond Requirements
§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 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.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of 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 not later than three days following the date of execution of the Contract. If the Work is to commence sooner 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, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS
§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

~~**.4** AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:~~
~~*(Insert the date of the E203-2013.)*~~

~~« »~~

.54 Drawings

Number	Title	Date

.6

.7 Addenda:

Number	Date	Pages

.8 ~~Other Exhibits:~~
~~(Check all boxes that apply and include appropriate information identifying the exhibit where required.)~~

~~[« »] AIA Document E204™ 2017, Sustainable Projects Exhibit, dated as indicated below:~~
~~(Insert the date of the E204-2017.)~~

~~« »~~

~~[« »] The Sustainability Plan:~~

~~Title~~	~~Date~~	~~Pages~~

[«X»] Supplementary and other Conditions of the Contract:

~~Document~~Title	~~Title~~Document	Date	Pages
–Supplementary Instructions to Bidders	002213-7		7

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

«Exhibit 1
Cost Proposal Form

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Supplementary and other Conditions of Contract 0073 00»

DOCUMENT 00 22 13-SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following supplements modify the AIA Document A701-2018 Instruction to Bidders. Where a portion of the above AIA documents is modified or deleted by these Supplementary Conditions, the unaltered portions of the above AIA documents shall remain in effect.

The term "Architect" is hereby defined as the primary designer of the project and may be referred to in Contract Documents as "Architect", "Designer" or "Engineer".

AIA Document A701-2018 INSTRUCTIONS TO BIDDERS

ARTICLE 2-BIDDER'S REPRESENTATIONS

Add Section 2.1.4.1-The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

Add Section 2.1.7-The Bidder is a properly licensed Contractor according to the laws and regulations of the State of North Carolina and meets qualifications indicated in the Bidding and Contracting Documents.

Add Section 2.1.8-The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Bidding and Contracting Documents.

Add Section 2.1.9-Bidder has investigated with governing authorities all required fees, permits, and other regulatory requirements and shall have included the cost of each in its bid. Bidder awarded a contract shall pay all such costs unless specifically stated otherwise in the Bidding Documents.

Add Section 2.1.10-By submitting a bid, Bidder agrees to waive any claim Bidder may have against the Owner or Architect arising out of or in connection with the administration, evaluation, or recommendation of any bid.

ARTICLE 3-BIDDING DOCUMENTS

Add Section 3.2.2.1-Submit Bidder's Requests for Interpretation in writing to Architect.

Add Section 3.3.6-All communication relating to this bid shall be directed to the Architect or Owner's Representative. Failure to meet this requirement may make the bid non-responsive.

Add Section 3.3.7-Approval of a proposed substitution is for a single project only. Specification or approval of products on Owner's previous projects does not constitute approval for use of product on this project.

Add Section 3.3.8-Comply with requirements in Document 002600 "Bidding Substitution Procedures." Only substitution requests submitted by a prime Bidder will be considered.

Add Section 3.4.4.1-Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:

1) 3.4.4.1.1-Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Bidding and Contracting Documents included in an unacknowledged Addendum.
2) Modifications to the Bidding and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

ARTICLE 4-BIDDING PROCEDURES

Add Section 4.1.1.1-Printable electronic Bid Forms and related documents are printed in Project Manual and available on UCPS website.

Add Section 4.1.8.1-The Bid shall include unit prices when called for by the Bidding and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.

Add Section 4.1.9-Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

Add 4.1.10-Bids shall include sales and use taxes as stipulated in Document 007300 “Supplementary Conditions.”

Revise Section 4.2.1-Bid Security shall be in the form of (1) Cash; (2) Cashier’s Check; (3) Certified Check on a Bond or Trust Company insured by the Federal Deposit Insurance Corporation, or (4) a Bid Bod executed by a Corporate Surety licensed under the laws of the State of North Carolina to execute such bonds. A Company check will not be accepted as a form of Bid Security.

Section 4.2.2- Modify the second sentence to read-Should the Bidder fail to enter into such a Contract within 10 days of issuance by the Owner or fail to furnish bonds if required the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

Add Section 4.2.5-Bids may not be withdrawn for a period of sixty (60) days after the Bid Date.

Section 4.3.2-Modify the second sentence to read- 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.

Add Section 4.3.2.1-Include Bidder’s Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.

Add Section 4.4.1.1-Such modification to or withdrawal of a bid may only be made by person authorized to act on behalf of the Bidder. Authorized person are those so identified in the Bidder’s corporate bylaws, specifically empowered by the Bidder’s charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.

Add Section 4.4.1.2-Owner will consider modifications to a bid written on the sealed bid envelope by authorized person when such modifications comply with the following: the modification is indicated by

a percent of stated amount to be added to or deducted from the bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification.

Add Section 4.5-Provide detailed cost breakdowns in writing no later than two business days following Architects' request.

Add Section 4.6 Provide a list of major subcontractors, suppliers, and manufacturers furnishing or installing products in writing and provided no later than two business days following Architects request. Include those subcontractors, suppliers, and manufacturers providing work totaling three percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

ARTICLE 5-CONSIDERATION OF BIDS

Add Section 5.2.1-Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

Add Section 5.4 Determination of Lowest Responsible Bid

5.4.1-The Owner will have the right to take such steps as he deems necessary to determine the ability of the Bidder to perform the Work and the Bidder shall furnish to the Owner such data for this purpose as the Owner may request.

5.4.2-In determining which bid is the lowest responsible bid, the Owner may take into consideration not only the amount of the bid but such of the following criteria as it, in its discretion, deems appropriate and may give such weight thereto as it deems appropriate.

a-The Bidder's financial ability to complete the Contract successfully without resort to its Surety.

b-The Bidder's prior experience with similar work on comparable or more complex projects.

c-The Bidder's prior history for the successful and timely completion of projects.

d-The Bidder's equipment and facilities.

e-The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time.

f-The Bidder's prior experience on other projects of the Owner, including the bidder's demonstrated ability to complete its work on these projects in accordance with the

Contract Documents and on time. The Owner reserves the right to consider as not responsible (and therefore unacceptable) any contractor or subcontractor presently in litigation with the Union County Board of Education. The Owner reserves the right to consider a Bidder on the State or Federal Debarred List as not responsible.

g-The Bidder's history of compliance with federal, state, and local laws, rules, and regulations.

h-Depending upon the type of the work, other essential factors.

5.4.3-The failure to submit requested information on a timely basis may result in the determination that the bidder is not responsible.

5.4.4-In the case of a tie for low bid (based upon base bid only) the Alternates (whether or not accepted at the time of award) and (if necessary) Unit Prices, shall also be used to determine the low Bidder.

5.4.5-Out-of-state bidders shall research and become fully aware of the specific requirements with regard to licensing requirements for out-of state Contractors proposing to do work in the state of North Carolina. Simple agreements with state licensed contractors, to hire them or pay them a fee for use of their license, may not be acceptable or compliant. Care should be taken when establishing joint contracts to bid and perform prior to bidding/award and non-compliant bidders are awarded contracts, the costs involved to make Contractors compliant shall be borne by that Contractor and shall not be cause for a change order for additional costs.

ARTICLE 6-POST BID INFORMATION

Add Section 6.1.1-Submit Contractor's Qualification Statement no later than two business days following Architect's request.

ARTICLE 7-PERFORMANCE AND PAYMENT BOND

Section 7.1.3-Modify the second sentence to read-Bonds may be secured in the form of (1) Cash; (2) Cashier's Check; (3) Certified Check on a Bond or Trust Company insured by the Federal Deposit Insurance Corporation, or (4) a Bond executed by a Corporate Surety licensed under the laws of the State of North Carolina to execute such bonds. A company check will not be accepted as a form of Performance and Payment Bond.

Section 7.1.4-Modify Section to Read-Both a Performance and Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

Section 7.2.1-Delete the first sentence and insert the following: The Bidder shall deliver the required bonds to Owner no later than ten (10) days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

Delete Section 7.2.3

ADD ARTICLE 9-EXECUTION OF THE CONTRACT

Add 9.1.1-Subsequent to the Notice of Intent to Award, and within (10) days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.

Add 9.1.2-Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds if not received within (10) days from issuance of the contract.

Add 9.1.3-Unless otherwise indicated in the Bidding and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the purchase order.

Add 9.1.4-In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or readvertise for bids.

END OF DOCUMENT 002213.

DOCUMENT 00 73 00 -SUPPLEMENTARY AND OTHER CONDITIONS OF THE CONTRACT

The following supplements modify the AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor; the AIA Document A201-2017 General Conditions of the Contract for Construction; the AIA Document E203-2013 Building Information Modeling and Digital Data Exhibit; the AIA Document G201-2013 Project Digital Data Protocol Form; and the AIA Document G201-2013 Project Building Information Modeling Protocol Form (the supplements are collectively referred to herein as "Supplementary Conditions". Where a portion of the above AIA documents is modified or deleted by these Supplementary Conditions, the unaltered portions of the above AIA documents shall remain in effect.

The term "Architect" is hereby defined as the primary designer of the project and may be referred to in Contract Documents as "Architect", "Designer" or "Engineer".

AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

Add the following sections after Section 3.3.3:

§ 3.4 It is expressly understood and agreed by and between the Contractor and the Owner that the Contract Time defined above for completion of the Work is a reasonable time for completion of same, taking into consideration the average climatic range and usual conditions prevailing in this locality.

§ 3.5 The Contractor shall achieve Final Completion of the Work within [30] days of the date of Substantial Completion unless specified otherwise in the bid document.

ARTICLE 5 PAYMENTS

Delete Section 5.1.7.1 and Section 5.1.7.1.1 and replace with the following:

§ 5.1.7.1 Until the Work is 50 percent complete, the Owner shall pay 95 percent of the amount due to the Contractor on account of progress payments, withholding 5% of the amount due (the "Contract Retainage"). At this time the Work is 50 percent complete and thereafter, the Architect may certify remaining partial payments to be paid in full.

Delete Section 5.1.7.2 and replace with the following:

§ 5.1.7.2 The Owner may elect to reinstate withholding of the Contract Retainage if the manner of completion of the Work and its progress do not remain satisfactory to the Architect of if the Surety withholds or revokes its consent, or for other good and sufficient reasons.

Delete Section 5.1.7.3 in its entirety.

Delete Section 5.3 in its entirety.

ARTICLE 7 TERMINATION OR SUSPENSION

Delete Section 7.1.1 in its entirety.

AIA Document A201-2017 General Conditions of the Contract for Construction

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

Add the following Section 1.1.1.1 after Section 1.1.1:

§ 1.1.1.1 The Contract documents executed or identified in accordance with Section 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

Add the following Section 1.1.5.1 after Section 1.1.5:

§1.1.5.1 Where only part of the Work is indicated, similar parts are considered repetitive. Where any detail is shown and components thereof are fully described, similar details not fully described are deemed to incorporate similar material and construction.

§1.2 Correlation and Intent of the Contract Documents

Add the following Section after Section 1.2.1.1:

§1.2.1.2 The Contractor acknowledges and agrees that the Contract Documents are sufficient to provide for the completion of the Work, including Work, whether or not shown or described, which may reasonably be inferred to be required for the completion of the Work in accordance with information given in the Contract Documents.

Add the following section after Section 1.2.3:

§1.2.4 If there should be a conflict between two or more of the Contract Documents, the following order of interpretation shall apply:

.1 Where requirements specifically set forth in the AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor are in conflict with other Contract Documents, the AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor shall govern.

.2 Where there is a conflict between the requirements of (1) the Supplementary Conditions and (2) the AIA Document A201-2017 General Conditions of the Contract for Construction; the AIA Document E203-2013 Building Information Modeling and Digital Data Exhibit; the AIA Document G201-2013 Project Digital Data Protocol Form; or the AIA Document G201-2013 Project Building Information Modeling Protocol Form, the requirements of the Supplementary Conditions shall govern, except where the requirements set forth in the Supplementary Conditions are contrary to law, in which case the legal requirements shall govern.

.3 The AIA Document A201-2017 General Conditions of the Contract for Construction, as supplemented, shall take precedence over the other Contract Documents except for the AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor.

.4 Where there is a conflict between the Drawings and Specifications or a conflict within the Drawings or within the Specifications, the conflict shall be brought to the attention of the Architect for determination and resolution of the conflict.

ARTICLE 3 CONTRACTOR

§3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Delete sentences 4, 5, and 6 from Section 3.3.1 and insert the following:

"If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give advance written notice to the Owner and Architect, informing the Owner and the Architect of the alternate means, methods, techniques, sequences, or procedures the Contractor intends to utilize in the performance of the Work, and unless the Owner of the Architect takes exception to the proposed means, methods, techniques, sequences or procedures, the Contractor shall proceed with the Work using the alternate means, methods, techniques, sequences or procedures that the Contractor has determined are safe."

Add the following sections after Section 3.3.2:

.1 The Jessica Lunsford Act enacted by the North Carolina General Assembly requires that the Contractor and subcontractors, consultants, sub-consultants, and venders be in compliance with this statute.

.2 The Contractor and subcontractors, consultants, sub-consultants, and vendors shall annually conduct a review of the State Sex Offender and Public Protection Registration Program, the State Sexually Violent Predator Registration Program and the National Sex Offender Registry for all employees who will provide services under this Contract. Any employee of the Contractor, subcontractor, consultant, sub-consultant, or vendor found to be registered on any of the lists identified herein shall not perform work under this Contract and shall be permitted to enter property owned by Union County Public School or Union County on behalf of Union County Public Schools. Failure to comply may result in legal action and termination of the Contract for default.

.3 It is the Contractor's responsibility to ensure that all subcontractors, sub-consultants and vendors involved with this Project are in compliance with this law.

.4 Employees of the Contractor, subcontractor, consultant, sub-consultant, and their vendors shall dress appropriately for a school environment and perform their work in a professional manner. Determination of compliance with this requirement shall be solely at the discretion of the Owner. Contractor shall immediately remove non-complying personnel from the Owner's property.

.5 Union County Public Schools is a tobacco-free facility. Employees of the Contractor, subcontractor, consultant, sub-consultant, and their vendors shall refrain from use of all tobacco products including e-cigarettes while on the Owner's property.

.6 Employees of the Contractor, subcontractor, consultant, sub-consultant, and their vendors shall comply with the Owner's safety projects, the Contractor's safety program

and, with state and federal safety regulations. The Contractor shall provide a copy of the Contractor's written safety program to the Owner's Facilities Project Manager within three business days of request.

§ 3.4 Labor and Materials

Add the following section to Section 3.4.1:

§3.4.1.1 Not later than 15 days following date of issuance of Notice of Intent to Award or commencement of the Work, whichever occurs first, the Contractor shall furnish in writing to the Architect a Product List indicating the names and model numbers of specific products, equipment and systems proposed for the Work unless specified otherwise in the bid document.

Delete Section 3.4.2 and substitute the following Section 3.4.2 and Sections .1 and .2:

§ 3.4.2 After the Contract has been executed, the Architect will consider a formal request for the substitution of comparable products in place of those specified only under the conditions and limitations set forth in Division 01 General Requirements. By making requests for substitutions, the Contractor:

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified, except as specifically indicated by the Contractor in writing as part of the request;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified.

§ 3.6 Taxes

Add the following Section 3.6.1 after Section 3.6:

§ 3.6.1 Sales and use tax on materials are included in the Contract Sum. The Contractor shall document sales and use tax paid by the Contractor and subcontractors on material purchases in accordance with NCGS 105-164.14c. The contractor shall submit certified documentation with each Application for Payment in a notarized form acceptable to the Owner. Refund of sales and use tax paid by the Contractor, if any, shall be for the benefit of the Owner.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

Add the following Sections 3.7.1.1 after Section 3.7.1:

§ 3.7.1.1 The Owner will pay the Capacity Use Fee (Impact Fee) for the Project. All other fees shall be the responsibility of the Contractor.

Add the following Sections 3.7.2.1 after Section 3.7.2:

§ 3.7.2.1 Contractor shall comply with the E-Verification requirements under Article 2 of Chapter 64 of the North Carolina General Statues.

§ 3.7.2.2 Contractor certifies that, as of the date listed within the contract documents, it is not on the Final Divestment List as created by the State Treasurer pursuant to NCGS §143-6A-4. In compliance with

the requirements of the Iran Divestment Act and NCGS § 143C-6A-5(b), Contractor shall not utilize in the Performance of the contract any subcontractor that is identified on the Final Divestment List.

Add the following Section 3.7.6 after Section 3.7.5:

§ 3.7.6 Contractor shall comply with project statement notice requirements of NCGS General Statute §44A-27, and shall ensure that subcontractors and suppliers likewise comply with respect to other subcontractors and suppliers, if any, who are not in direct contract with the Contractor.

. 1 The Contractor shall indemnity and hold harmless the Owner from any costs, including without limitation costs of delays or attorney fees incurred by Owner, arising out of any dispute or litigation involving sub-subcontractors and subcontractors or Contractor including without limitation any disputes arising out of Contractor's or its subcontractors' failure to comply with applicable lien statutes. All costs of such dispute or litigation involving sub-subcontractors and subcontractors or Contractor shall be borne by Contractor.

§ 3. 9 Superintendent

Add the following sections to Section 3.9.1:

.1 The superintendent shall be considered competent if he has successfully completed at least two other similar projects of similar scope and complexity to this Project while serving in the role of Project superintendent.

.2 The superintendent shall be on site while work is being performed.

Add Section 3.9.4 to Section 3.9:

§ 3.9.4 The Contractor shall maintain the same approved Project Manager and Field Superintendent from the time of issuance of the Notice to Proceed until the Date of Substantial Completion, or shall submit proposed changes in personnel to the Architect in accordance with 3.9.2.

§ 3.10 Contractor's Construction Schedules

Add the following Section 3.10.4 after Section 3.10.3:

§ 3.10.4 Based upon local Weather data, the following I 0-year average shall establish the number of rain days to be included in the Contractor's Construction Schedule as norn1al. Rain days are defined as periods of 24 hours within which precipitation is one-tenth (0.1) of an inch or greater. Rain days shall be understood to be work days, exclusive of holidays, Sundays and other non-working days. Rain-related days will be considered based upon amounts of precipitation encountered during the construction process. The Contractor shall use these monthly averages when establishing the construction schedule for this project. Claims for delays due to abnormal rain delays will not be considered until the number of rain days during which critical path work is actually delayed exceeds the number allowed in the schedule as follows:

January: 6 Days	May: 6 Days	September: 4 Days
February: 6 Days	lune: 5 Days	October: 4 Days
March: 6 Days	July: 6 Days	November:4 Days
April: 5 Days	August: 6 Days	December: 6 Days

.1 Rain days, as identified above, are to aid the Contractors in their scheduling. These days are included in the total time allowed for construction as defined in Article 8 of these Supplementary General Conditions. Used and unused days are not available for extending the project time nor may they be used to decrease the project time. Rain days shall cease upon the drying in/enclosure of the building unless the Contractor can prove his claim for weather related delay based upon extreme conditions or Acts of God.

ARTICLE 4 ARCHITECT

§ 4.1 General
Add the following section after Section 4.1.1:

§ 4.1.1.1 The term "Architect," "Architect/ Engineer," or "Engineer" as used in the Contract Documents means the Architect or his authorized representative.

§ 4.2 Administration of the contract
Delete the fifth sentence of Section 4.2.4 in its entirety.

ARTICLE 5 SUBCONTRACTORS
Add the following Section 5.1.2.1 after Section 5.1.2:
§ 5.1.2.1 Sub-Subcontracting of work is discouraged on Union County Public School Projects. The Contractor is directly responsible for the performance of Subcontractors and their Sub-subcontractors. If the Contractor chooses to allow sub-subcontracts for portions of the Work, the Contractor shall remain directly responsible for sub-subcontractor's actions and remedies required. The Owner shall not be inconvenienced by conflicts with Subcontractors or their Sub-subcontractors. The Contractor shall make or cause to be made corrections to defective work and repairs in a responsive manner without regard to the outcome of conflict resolution between subcontracted parties.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work
Add Section 5.2.1.1 after Section 5.2.1:

§ 5.2.1.1 Not later than 14 days following date of issuance of Notice to Proceed or commencement of the Work, whichever occurs first, the Contractor shall furnish in writing to the Architect the Manufacturer/Subcontractor List consisting of a complete list of names of persons or entities proposed as manufacturers, fabricators, or material suppliers for the products, equipment and systems proposed for the Work and, where applicable, the name of the installing Subcontractor.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.2 Mutual Responsibility

Delete Section 6.2.3 and replace with the following:
§ 6.2.3 If a Separate Contractor initiates legal or other proceedings against the Owner on account of damage alleged to have been caused by the Contractor, the 0wner shall notify the Contractor, who shall defend such proceedings at its own expense, and if judgment or award against the

Owner arises therefrom, the Contractor shall pay or satisfy it and shall reimburse the Owner for

attorneys' fees and court or other costs which the Owner has incurred over and above those paid for directly by the Contractor.

§ 6.2.4 (Delete the word .... "wrongfully" .... in this Section).

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General
Add Section 7.1.4, 7.1.5, and 7.1.6:
§ 7.1.4 Overhead and profit applied to pricing of changes in the Work where the basis of payment for the change is cost plus overhead and profit may be stated separately or combined but, in either case, should distinguish between:

.1 the amounts to be paid to the Contractor for Work performed by the Contractor with that Contractor's own forces and for materials purchased directly by the Contractor (not through a Subcontractor).

. 2 the amounts to be paid to the Contractor and Subcontractor for Work performed by the Subcontractor with that Subcontractor's own forces and for materials or purchased directly by that Subcontractor (not through a Sub-subcontractor).

§ 7.1.5 The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on the following schedule, unless otherwise stated in the AIA Document A 101 - 2017 Standard Form of Agreement Between Owner and Contractor:

. I For extra Work completed by the Contractor with his own labor, not more than 15 percent shall be added as the allowance for overhead and profit.

.2 For extra Work completed by Subcontractors of the Contractor, not more than 10 percent shall be added as the allowance for overhead and profit.

.3 For Work deleted which would have been completed by the Contractor, with his own labor, not less than IO percent shall be credited to the Owner as the allowance for overhead and profit.

.4 For Work deleted which would have been completed by Subcontractors of the Contractor, not less than 5 percent shall be credited to the Owner by the Contractor as the allowance for overhead and profit.

§ 7. 1.6 In order to facilitate checking of quotations for extras or credits, all proposals shall be accompanied by a complete itemization of costs including labor, materials, and Subcontractors. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.

§ 7.3 Construction Change Directives
Revise the fourth phrase in Section 7.3.4 as follows:
§ 7.3.4 Change: " .... an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount...: to read:" ... a fixed percentage fee as provided in Section 7.1.5 above for total profit and overhead."
Revise the last sentence of Section 7.3 .8 as follows:
§ 7.3.8 Change to read: "When both additions and deletions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of net increase or decrease, if any."

ARTICLE 8 TIME

§ 8.3 Delays and Extension of Time

Delete from § 8.3.1 the following text: ... ", adverse weather conditions documented in accordance with Section 15.1.6.2".

Insert new Sections 8.3.2 and 8.3.3 as follows:
§ 8.3.2 If the progress or completion of the Work is delayed by any fault, neglect, act or failure to act on the part of the Contractor or any one acting for or on behalf of the Contractor, then the Contractor shall, in addition to all of the other obligations imposed by this contract and by law upon the contractor, and at no cost or expense to the Owner, work such overtime or require the appropriate sub-contractor to work such overtime as may be necessary to make up for all time lost and to avoid delay in the progress and completion of the work. The "premium" cost of all such overtime work shall be paid by the Contractor.

. I For the purposes of this Article, "sub-contractors" shall be deemed to be acting for and on behalf of the Contractor.

§ 8.3.3 Should the progress or completion of the Work be delayed by any fault, neglect, act or failure to act on the part of the Contractor or any one acting for or on behalf of the Contractor so as to cause any additional cost, expense, liability or damage to the Owner or any damage or additional cost or expense for which the Owner may or shall become liable, the Contractor shall and does hereby agree to compensate the Owner for, and to indemnify the Owner against, all such costs, expenses, liabilities and damages.

Renumber existing Section 8.3.2 as 8.3.4, and renumber existing Sections 8.3.3 as 8.3.5.

Add Sections 8.3.4.1, 8.3.4.2, and 8.3.4.3 to Section 8.3.4:
§ 8.3.4.1 Requests for extensions of time due to unusual adverse weather conditions occurring prior to completion of the roof and temporary or permanent building enclosure will be evaluated by the Owner when submitted by the Contractor in accordance with the requirements of Division 01 Section "Contract Modification Procedures."
§ 8.3.4.2 Extensions of Contract Time due to unusual adverse weather conditions shall not entitle the Contractor to claims for cost due to extended project overhead.
§ 8.3.4.3 If the Owner's performance is delayed at any time by Force Majeure (as hereinafter defined), the time for such performance by Owner or acceptance of Goods and/or Services will be equitably adjusted by allowing additional time for performance equal to any periods of Force Majeure. "Force Majeure" shall mean any delays caused by acts of God, riot, war, terrorism, inclement weather, labor strikes, material shortages and other causes beyond the reasonable control of Owner.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.3 Applications for Payment
Add Section 9.3.1.3 to Section 9.3.1:
§ 9.3.1.3 The Contractor shall submit with each Application for Payment a completed Statement of Sales Tax Paid and Minority Business Enterprise documentation in a form acceptable to the Owner.

Add Sections 9.3.2.1 through 9.3.2.4 to Section 9.3.2:
§ 9.3.2.l In requesting payment for materials stored on or off the site, the Contractor shall submit with his Application for Payment the following:

.1 an itemized list of the stored material prepared in sufficient detail to identify the materials and their value. Include an accounting for new items stored, paid items that continue in storage, and items previously stored and since incorporated in the Work.

.2 evidence such as bills of sale or such other proof as may be requested by the Architect to substantiate that the materials listed have been paid for by the Contractor, or, for materials stored at the site only, a notarized statement from the materials supplier stating that the materials will become the property of the Owner upon payment by the Owner to the Contractor.

§ 9.3.2.2 For material stored off the site, the Contractor shall additionally submit with his Application for Payment the following:

.1 evidence that the materials are stored at the location previously agreed to in writing as provided by Section 9.3.2 of the General Conditions. No payment will be made for material stored off the site until the storage location has been agreed upon in writing. No payment will be made for material stored more than 50 miles from the Project site.
.2 evidence that the storage location is bonded in a manner satisfactory to the Architect.
.3 evidence that the materials are insured while in storage and while in transit to the site.
.4 evidence that transportation to the site will be provided by the Contractor.

§ 9.3.2.3 Stored materials may be reviewed in their storage location by the Architect.
§ 9.3.2.4 Contractor shall reimburse the Owner for the Architect's cost for inspections of off-site stored materials, to include his Time (travel, site observation, and office-related duties) per the hourly rate established by the fee/rate schedule attachment to Owner-Architect Agreement), the cost for Engineering Consultants if their services are needed, and will also include travel expenses at IRS approved travel expense rate but no less than $0.50 per mile from base of operations office to the Project site or storage site and back. In no case will the charges be less than the minimum set at $500.00 per inspection.

§ 9.8 Substantial Completion
Add the following section after Section 9.8.1:
§ 9.8.1.1 Substantial Completion shall also include final approval for occupancy and use by authorities having jurisdiction.

Add Sections 9.8.2.1 and 9.8.2.2.to Section 9.8.2:
§ 9.8.2.1 The Architect shall be entitled to rely upon the Contractor's comprehensive list of items to be completed or corrected in conjunction with the Architect's inspection to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amount paid to the Architect for preparation of such comprehensive list of items if such preparation is required in order to facilitate the Architect's determination of Substantial Completion.
§ 9.8.2.2 The Architect will review the general condition of the Work and the Contractor's comprehensive list prior to the Architect's inspection to determine whether the nature or scope of

work left to be completed or corrected will preclude immediate and full owner occupancy, and will not proceed with inspection for Substantial Completion. but will reschedule the inspection at such time that the Contractor has indicated that the work remaining to be completed or corrected is consistent with the definition of Substantial Completion.

Add Section 9.8.3.1 to Section 9.8.3:
§ 9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amount paid to the Architect, including normally reimbursable expenses, for any additional inspections.

§ 9.10 Final Completion and Final Payment
Add the following sentence to Section 9.10.2:
"The Contractor shall furnish such evidence as may be necessary to show that out of state subcontractors or suppliers have fully met the requirements of payment of taxes as established in the law of the State or local subdivision thereof which may be in effect at the time of final payment. The Owner will require the submission of such proof or evidence before final payment will be approved or made."

Add Section 9.10.2.1 to Section 9.10.2:
§ 9.10.2.1 Except with the consent of the Owner, the Architect will perform no more than one(!) inspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amount paid to the Architect, including normally reimbursable expenses, for any additional inspections.

Add the following section to Section 9.10.3:
§ 9.10.3.1 Owner's Option Final Payment: If at the time final completion is scheduled there are remaining uncompleted items, the contract may be closed and contract closeout completed, an amount equal to 250 percent of the value of each item as determined by the Architect shall be withheld for these items, as value to the Owner to provide for the Owner's completion of the work and related costs for Owner's and Architect's additional services.

Add the following Sections .5, .6, and .7 to Section 9.10.4:

.5 Claims for Indemnification;
.6 Claims about which the Owner has given the Contractor written notice;
.7 Claims arising after final payment

Add Section 9.11:
§ 9.11 Costs for Additional Inspections
§ 9.11.1 The Architect's costs for additional inspections will include his Time (Travel, Site Visitation and Office) at the rate established in the fee/rate schedule attachment to the Owner Architect Agreement, the cost for Engineering Consultants if their services are needed, including their travel expenses at IRS approved Travel Expense Rate but no less than $0.50 per mile from base of operations office to the project site and back. In no case will the charges be less than the minimum set at $500.00 per inspection.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.2 Safety of Persons and Property
Add Section I 0.2.2.1 after Section I 0.2.2:
§ 10.2.2.1 In the event that review, inspection or other action by regulatory agencies or other parties results in the imposition of fines, fees, or other costs due to the failure of the Contractor to comply with said applicable laws, ordinances, rules, regulations and lawful orders, the Contractor shall hold harmless the Owner, the Architect, and Owner's separate contractors, if any, from all consequences arising from the Contractor's noncompliance.

§ 10.4 Emergencies

Add the following sentence to Section I 0.4:
“Nothing in this section shall be construed as relieving the Contractor from the cost and responsibility for emergencies covered hereby, which with normal diligence, planning, and the close supervision of the Work as required under the Contract, could have been foreseen or prevented."

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.2 Correction of Work

Add Section 12.2.2.1.1 to Section 12.2.2.1:
12.2.2.1.1 Leakproof Envelope Provision: The one-year period for correction of Work shall be extended to a two-year period for all exterior envelope elements of the Work should one or more fail to serve as a leakproof water and/or air barrier. The Contractor's responsibility under this Section shall extend to the repair of all damage to the building and building contents resulting from such failure.

Delete the words "one-year" from Sections 12.2.2.2 and 12.2.2.3.

Add Section 12.2.2.4 to Section 12.2.2:
12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance of the Work of the Contractor.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

Add the following sentence to the end of Section 12.3:
"The acceptance of nonconforming Work by the Owner shall be by written Change Order or Construction Change Directive, signed by the Owner's authorized representative. No person has authority to accept nonconforming work except the Owner."

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

Delete Section I 4.4 and all subparts and replace with the following:
§ 14.4 Termination by the Owner for Convenience
§ 14.4.1 The Owner may, at any time, terminate the Contract in whole or in part 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 to the extent they relate to the Work terminated and enter into no further subcontracts and purchase orders.

§ 14.4.3 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, then the Owner shall only be liable to the Contractor for those costs reimbursable to the Contractor in accordance with Section l 4.4.4, plus a markup of l O percent for profit and overhead on the actual fully accounted costs recovered under Section 14.4.4; provided however, that if there is evidence that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed hereunder and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss.

§ 14.4.3.1 After receipt of a notice of termination for convenience, the Contractor shall submit to the Owner its termination claim in the form and with certification prescribed by the Owner. Such claims shall be submitted promptly but in no event later than three (3) months from the effective date of termination, unless one or more extensions in writing are granted by the Owner upon request of the Contractor made in writing within such three (3) month period or authorized extension thereof. However, if the Owner determines that the facts justify such action, it may receive and evaluate any such termination claim at any time after such three (3) month period or any extension thereof. Upon failure of the Contractor to submit its termination claim within the time allowed, the Owner may detem1ine, on the basis of information available to it, the amount, if any. due to the Contractor by reason of the termination.

§14.4.4 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, the Owner shall pay the Contractor the amounts determined by the Owner as follows:

.1 an amount for supplies, services, or property accepted by the Owner pursuant to Section 14.5.1.6 or sold or acquired pursuant to Section 14.5.1. 7 and not heretofore paid for, and to the extent provided in the Contract such amount shall be equivalent to the aggregate price for such supplies or services computed in accordance with the price or prices specified in the Contract appropriately adjusted for any saving of freight or other charges;

.2 the total of the cost incurred in the performance of the Work through the date of termination including initial costs and preparatory expense allocable thereto but exclusive of any costs attributable to supplies or services paid or to be paid for under Section 14.4.4. I; and

.3 provided, however, that neither the Owner nor the Design Consultant will be liable for payments to subcontractors pursuant to Section 14.4.4.2 unless each subcontractor contains termination provisions identical to those set forth in Article 14. The Owner and the Design Consultant will not be liable to the Contractor or any of its subcontractors for any costs associated with termination if the subcontract of the pa11y involved does not include the proper termination clauses.

§ 14.4.5 In arriving at any amount due the Contractor pursuant to Section 14.4. there shall be deducted the following:

. 1 all unliquidated advance or other payments on account theretofore made to the Contractor applicable to the terminated portion of the Contract;

.2 any claim which the Owner may have against the Contractor;
.3 such amount as the Owner determines to be necessary to protect the Owner against loss because of outstanding or potential liens or claims; and
.4 the agreed price for, or the proceeds of sale of, any materials, supplies or other things acquired by the Contractor or sold pursuant to the provision of Section 14.5.1.7 and not otherwise recovered by or credited to the Owner.

§ 14.4.6 The total sum to be paid to the Contractor and Section 14.4 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made or to be made for Work not terminated and as otherwise permitted by the Contract. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor, as provided in Section 14.4.4, the fair value, as determined by the Owner, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to Section 14.5.1. 7.

Add Section 14.5 as follows:
§ 14.5 General Termination for Convenience Provisions
§ 14.5.1 After receipt of a notice of termination for convenience from the Owner, pursuant to Section 14.4, and except as otherwise directed by the Owner, the Contractor shall:
§ 14.5.1.1 stop work under the Contract on the date and to the extent specified in the notice of termination;
§ 14.5.1.2 place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the Contract as is not terminated;
§ 14.5.1.3 terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;
§ 14.5.1.4 at the option of the Owner, assign to the Owner in the manner, at the times and to the extent directed by the Owner, all of the rights in the contracts so terminated, in which case the Owner shall have the right, at its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
§ 14.5.1.5 settle all outstanding liabilities and all claims arising out of such termination or orders and subcontracts with the approval or ratification of the Owner, to the extent may require or ratification shall be final for all the purposes of this Article;

§ 14.5.1.6 transfer title and deliver to the entity or entities designated by the Owner, in the manner, at the times and to the extent directed by the Owner to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the Work as had been terminated, the following:

(1) the fabricated or unfabricated parts, work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and
(2) the completed or partially completed plans, drawings, information, releases, manuals and other property related to the Work and which, if the Contract had been completed, would have been required to be furnished to the Owner;

§ 14.5.1.7 use its best efforts to sell, in the manner, at the times, to the extent and at the price or prices directed or authorized by the Owner, any property of the types referred to in Section 14.5.1.6; provided, however, that the Contractor:

(1) shall not be required to extend credit to any buyer, and

(2) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under the Contract or shall otherwise be credited to the Contract Sum covered by the Contract or paid in such other manner as the Owner may direct;

§ 14.5.1.8 complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

§ 14.5.1.9 take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to the Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

§ 14.5.2 The Contractor shall, from the effective date of termination until the expiration of three (3) years after final settlement under the Contract, preserve and make available to the Owner, at all reasonable times at the office of the Contractor, but without direct change to the Owner, all its books, records, documents, and other evidence bearing cost on the costs and expenses of the Contractor under the Contract and relating to the Work terminated hereunder, or to the extent approved by the Owner, photographs, micro-photographs or other authentic reproductions thereof.

§ 14.5.3 lf the termination for convenience, pursuant to Section 14.4, be partial, the Contractor may file with the Owner a claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not tem1inated by the notice of termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this Section must be asserted within three (3) months from the effective date of the notice of termination.

§ 14.5.4 The Contractor shall refund to the Owner any amounts paid by the Owner to the Contractor in excess of costs reimbursable under Section 14.4.

§ 14.5.5 The Contractor shall be entitled to only those damages and that relief from termination by the Owner as specifically provided in Section 14.4.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1.5 Claims for Additional Time

Add Sections I 5.1.6.3, 15.1.6.4, and 15.1.6.5 after Section 15 .1.6.2:

15.1.6.3 Claims for increases in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction scheduled indicating all the activities affected by the circumstances forming the basis of the Claim.

15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor, or for delays not affecting tasks not identified as critical tasks affecting the date of completion of the Work.

15.1.6.5 The Contractor has the option to purchase such insurance and riders to his insurance (Inland Marine Floater policies to Builders Risk Insurance to cover the following potential losses: Theft, Business Interruption, Extra Expense, Installation, Contractors Equipment) as he deems prudent to cover possible losses due to acts of God (force majeure) including loss of income and financial damages due to loss of

income caused by delays in construction from a covered peril. This option shall be the Contractor's sole remedy for damages not a result of Owner, Architect, Contractor or their agents' actions, omissions, or failures to take action. The Contractor agrees to make no claim for damages for delay in the performance of this Contract and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of the Work as provided under the change order provisions of Article 7.

Add Article 16 as follows:

ARTICLE 16: LIQUIDATED DAMAGES

§ 16.1 The Owner and Contractor recognize that time is of the essence to this Contract, and that a delay in achieving Substantial Completion or Final Completion is a breach and will necessarily cause damages to the Owner. Such damages include but are not limited to:

.1 Delayed or diminished use of public facilities
.2 Inconvenience to students, staff and public
.3 Increased inspection, oversight and administrative costs to the Owner
.4 Diversion of the Owner's employees from other tasks and projects
.5 Increased and extended project overhead
.6 Inefficiencies and loss of productivity

§ 16.2 All parties acknowledge that said damages are likely to occur but would be difficult to ascertain or determine, and that a legal proceeding to prove such damages would be time consuming and expensive. Therefore, in the event of delayed performance the following amounts will be charged against the Contractor, as liquidated damages and not as a penalty:

.1 The amount of $500 per calendar day for failing to meet the Substantial Completion Date, calculated until substantial completion is actually achieved; and
.2 The amount of$250 per calendar day for failing to meet the Final Completion Date, calculated until final completion is actually achieved.

§ 16.3 The above amounts for liquidated damages are separate and cumulative. They are calculated concurrently in the event Substantial Completion is not achieved until after the specified Final Completion Date. All parties agree that said liquidated damages are a reasonable estimate of the damages to Owner caused by delayed performance and that they are not a penalty.

§ 16.4 The Owner may withhold liquidated damages from any payment to Contractor. Making final payment shall constitute a waiver of the Owner's right to liquidated damages not withheld unless the right to assess liquidated damages is specifically reserved in writing by the Owner. The Owner's entitlement to liquidated damages is specifically reserved in writing by Owner. The Owner's entitlement to liquidated damages shall not be considered a "Claim" subject to the time limitation for asserting Claims, but rather accrues automatically upon the Contractor's failure to meet the Substantial Completion Date and/or Final Completion Date.

§ 16.5 Liquidated damages shall not be assessed for the Contractor's delayed performance if and to the extent the delay is due to acts or omissions of the Owner or other contractors on the project, or to other events beyond the Contactor's control. Provided, however, that the contract provides a procedure by which the Contractor may make a Claim for an increase in the Contract Time, and it is Contractor's responsibility to follow the Claim procedure in a timely manner in order to obtain additional time to perfom1. Provided further, that failure by the Contractor to timely Claim and obtain additional time under said contract procedure constitutes a waiver, in which case the Owner shall be entitled to liquidated damages for delayed performance without any need for the Owner to establish that the Contractor was responsible for the delay.

§ 16.6 The Owner's entitlement to liquidated damages from Contractor shall be governed by this liquidated damages provision and shall not be affected by or offset by the Owner's assessment of liquidated damages against any other contractor.

§ 16.7 The parties acknowledge that this liquidated damages provision is not intended to apply to all additional costs incurred by Owner as a result of breach or delay. Specifically, this liquidated damages provision does not apply to additional costs incurred by Owner for correction of defective work or completion of the construction contract; additional legal, design professional and construction management costs resulting from breach or delay; and any claims by other contractors resulting from breach or delay. Such damages, Losses and expenses are likely to be ascertainable in the event of a breach are thus outside the scope of this liquidated damages provision. The parties agree that the Owner's right recover liquidated damages for delay is in addition to, and not in lieu of recovery of such ascertainable items of damages.
§ 16.8 The Owner's right to liquidated damages shall not be affected or waived by the Owner's termination of the contract upon material breach by the Contractor, nor by the Owner's permitting the Contractor to continue and finish the work or any part thereof after the expiration of the specified completion dates.''

Add Article 17 as follows:
ARTICLE 17: CONFIDENTIAL INFORMATION
§ 17.1 Contractor shall not disclose any Confidential Information as hereafter defined. "Confidential Information" shall consist of(a) any information pertaining to students or students' official records; (b) any information pertaining to personnel records of Owner employees; (c) any information pertaining to designs, know-how, techniques, devices, drawings, specifications, patterns, technical information, documents, business plans, item requirements, forecasts and similar data, oral, written or otherwise, conveyed by Owner to Contractor in connection herewith, or procured, developed, produced, manufactured or fabricated by Contractor in connection with Contractor's performance hereunder (the substance of clause (c) is hereafter referred to as "Project Information"); and (d) any information required to be kept confidential by law. Confidential Information may be disclosed as required by law. As used in this section, "required by law" shall include disclosures compelled by lawful subpoena, government regulation, court order, or demand pursuant to North Carolina Public Records Law, or any other lawful process; provided, however, that immediately upon receipt of any such subpoena, order or demand, Contractor shall notify Owner of the impending disclosure of records to afford Owner an opportunity to avail itself of legal process to prevent the disclosure or to seek confidential treatment of the disclosure.
§ 17.2 Security. Contractor's shall maintain commercially reasonable security measures in place to help protect against the loss, misuse. and alteration of Confidential Information.
§ 17.3 Additional Indemnification. To the fullest extent permitted by law, Contractor shall indemnify, defend and hold harmless Owner, its and directors, officers, managers, employees and agents, from all suits, claims, costs, damages and other liabilities, including reasonable attorneys' fees as incurred by counsel of Owner's choice, relating to or arising from (a) Contractor's failure to maintain the security and integrity of Confidential Inforn1ation and (b) any claim for infringement of any copyright, trade secret, trademark, tradename, service mark, patent, or other law or regulation concerning intellectual and/or proprietary prope1ty rights.
§ 17.4 Effect of Termination and Orderly Transition. Upon expiration or notification of termination of this Contract for any reason, Contractor will cooperate in good faith with Owner to provide for an orderly transfer of any Confidential Information to Owner *("Orderly Transition")* and according to the terms of this section:

a. Scope of Work for Orderly Transition. Within 30 days of notification by Owner that this Contract is being terminated, the parties will create and execute a scope of work document detailing tasks, the responsible parties for individual tasks, and timeframes for completion of tasks necessary to complete an Orderly Transition. The final, executed Orderly Transition scope of

work shall be incorporated into this Contract and become subject to its terms. Contractor's failure lo a) cooperate in developing the Orderly Transition scope of work b) execute an Orderly Transition scope of work; or c) abide by the executed Orderly Transition scope of work shall be deemed a material breach of the Contract Documents.

b. Time Frame. Unless otherwise mutually agreed in an executed Orderly Transition scope of work, Contractor shall continue to perform under the Contract while Owner migrates its Confidential Information in the Orderly Transition process. Contractor agrees that, as part of the Orderly Transition process and within the specified time frame, it will transfer to Owner all of the Confidential Information provided to Contractor by Owner pursuant to this Contract. Contractor will provide Confidential Information in a commercially reasonable format as agreed in the Orderly Transition scope of work at no additional cost.
c. Destruction of Confidential Information after Orderly Transition. Unless otherwise mutually agreed in an executed Orderly Transition scope of work. Contractor agrees that after returning all Confidential Information to Owner pursuant to paragraph (b) above it will destroy all remaining copies of Confidential Information and back-up Confidential Information in its possession, contained in or on any medium (such as a storage area network or "SAN") or as may be stored offsite, within 30 days of completion of Orderly Transition. Contractor shall provide Owner with a detailed summary of the destruction process and standards to be utilized by Contractor with respect to the electronic Confidential lnformation and Owner shall approve such process and standards prior to Contractor commencing such destruction. Provided, Contractor may retain copies of any Project lnformation to the extent it does not contain components of sensitive public security plans or information as described under NC General Statute *§* 132-1.7.

EXHIBIT A - INSURANCE AND BONDS

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General
Add the following to the end of Section A.3.1.1: Certificates shall list the Owner as Union County Public Schools, Monroe, NC 28112. The Contractor shall furnish one copy of each Certificate of lnsurance herein required attached to each copy of the Agreement, plus three additional copies of each Certificate of Insurance herein required, which shall specifically set forth evidence of all coverage required under the Contract Documents. The Contractor shall further furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

Add Sections A.3.1.4 and A.3.1.5 to Section A.3.1 after Section A.3.1.3:
§ A.3.1.4 Should the Contractor have any outstanding claim against his/her current insurance policies, he/she shalt increase the dollar amount of insurance coverage above that specified by the dollar amount of the outstanding claim.
§ A.3.1.5 If the insurance is written on a Commercial General Liability policy form, the certificates shall be ACORD form 25, completed and supplemented in accordance with AIA Document 0715 - 2017, Supplemental Attachment for ACORD Certificate of Insurance 25.

In Section A.3.2.2.1, insert the phrase ''five hundred thousand dollars" and the number "500,000," respectively, in the first and second blank spaces so as to read: “· ... not less than five hundred thousand dollars ($500,000) each occurrence .... "; insert the phrase ''one million dollars" and the number "1,000,000," respectively, in the third and fourth blank spaces so as to read: " ... one million dollars

($1,000,000) general aggregate .... "; and insert the phrase "one million dollars" and the number "1,000,000." respectively, in the fifth and sixth blank spaces so as to read:" ... one million dollars ($1,000,000) aggregate for products-completed operations hazard.

§ A.3.2 Contractor's Required Insurance Coverage
Add Sections A.3.2.2.3 and A.3.2.2.4 after Section A.3.2.2.2:
§ A.3.2.2.3 The Contractor's Commercial General Liability policy under Section A.3.2.2 shall:

.1 Be endorsed to have the General Aggregate apply to this Project only.
.2 Include coverage sufficient to meet the obligations in AIA Document A201-2017 under Section 3.1.8.
.3 Include coverage for Premises Operations (deleting X C or U exclusions), Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, and Broad Form Property Damage.

§ A.3.2.2.4 Products and Completed Operations insurance shall be maintained for a minimum period of at least one year after either 90 days following Substantial Completion or final payment, whichever is earlier.

In Section A.3.2.3, insert the phrases "and hired" and "five hundred thousand dollars," and the number "500,000," so as to read: "Automobile Liability covering vehicles owned, and hired and non-owned vehicles used, by the Contractor, with policy limits not less than five hundred thousand dollars ($500,000) per accident .... "

Delete the period at the end of Section A.3.2.5 and add:
" ... including coverage for private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project."

§ A.3.3 Contractor's Other Insurance Coverage
Add an "X'' in the box beside Section A.3.3.2.1.

Add Section A.3.3.2.1.1 to Section A.3.3.2.1
§ A.3.3.2.1.1 The insurance required by Section A.3.3.2.1 is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment, which shall be subject to the provisions of Section 11.3.

Delete Section A.3.4 in its entirety and insert the following new Section A.3.4:
§ A.3.4 Performance Bond and Payment Bond
Upon execution of the Contract Documents, the Contractor shall furnish to the Owner a Performance Bond and a separate Labor and Material Payment Bond, acceptable to the Owner and underwritten by a surety authorized to do business in North Carolina, each in an amount equal to 100 percent of the Contract Sum for each bond. The bonds shall guarantee the Contractor's faithful performance of the Contract and payment of all obligations arising thereunder. The bonds shall remain in force until the Work has been completed and accepted by the Owner, the provisions of all guarantees required by these Contract Documents have been fulfilled, and the warranty periods and period for correction of the Work have expired, or the period for filing mechanics' liens has expired, whichever occur latest, after

which time the bonds shall lapse. The Contractor shall bear all costs in connection with the bonds as a part of the Contract. One executed copy of each bond shall be attached to each executed copy of the Contract Documents prior to the execution of the Contract Documents by the Owner.

. 1 These bonds shall be furnished to the Owner in the "Standard Form of Performance Bond and Labor and Material Payment Bond", AJA Document A312, latest edition.

.2 The Contractor 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.

AIA Document E203 - 2013: Building Information Modeling and Digital Data Exhibit

ARTICLE 1: GENERAL PROVISIONS

Replace the word "Parties" with "Contractor" in Section 1.2

Delete Section 1.4.8:
Renumber Section 1.4. 9 as Section 1.4.8.
Renumber Section 1.4.10 as Section 1.4.9.
Renumber Section 1.4.11 as Section 1.4.10.
Renumber Section 1.4.12 as Section 1.4.11.

ARTICLE 2: TRANSMISSION AND OWNERSHIP OF DIGITAL DATA.
Delete Section 2.2 and Section 2.2.1.
Renumber Section 2.3 as Section 2.2.
Renumber Section 2.4 and Section 2.3.

END OF DOCUMENT 00 73 00

UCPS
UNION COUNTY PUBLIC SCHOOLS
Purchasing and Contract Division

201 Venus Street
Monroe, NC 28112
Phone 704.296.6320 Fax 704.283.2371
www.ucps.k12.nc.us

ADDENDUM 1

PROJECT: **Wesley Chapel Elementary School-Rooftop Unit Replacements (HVAC)**
4-97380026

DUE DATE: **2:00 p.m., January 10, 2024**

Contractor shall fulfill all requirements listed within the bid documents, including additions and changes noted below.

Revise: Bid Due Date has been extended to 2:00 p.m., January 10, 2024.

Addendum 2 is planned for release in early January and will consist of revised drawings for the gymnasium rooftop unit.

Bidders will be provided a time to revisit the school.

End of Addendum

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ADDENDUM 2

PROJECT: **Wesley Chapel Elementary School-Rooftop Unit Replacements (HVAC)**
4-97380026

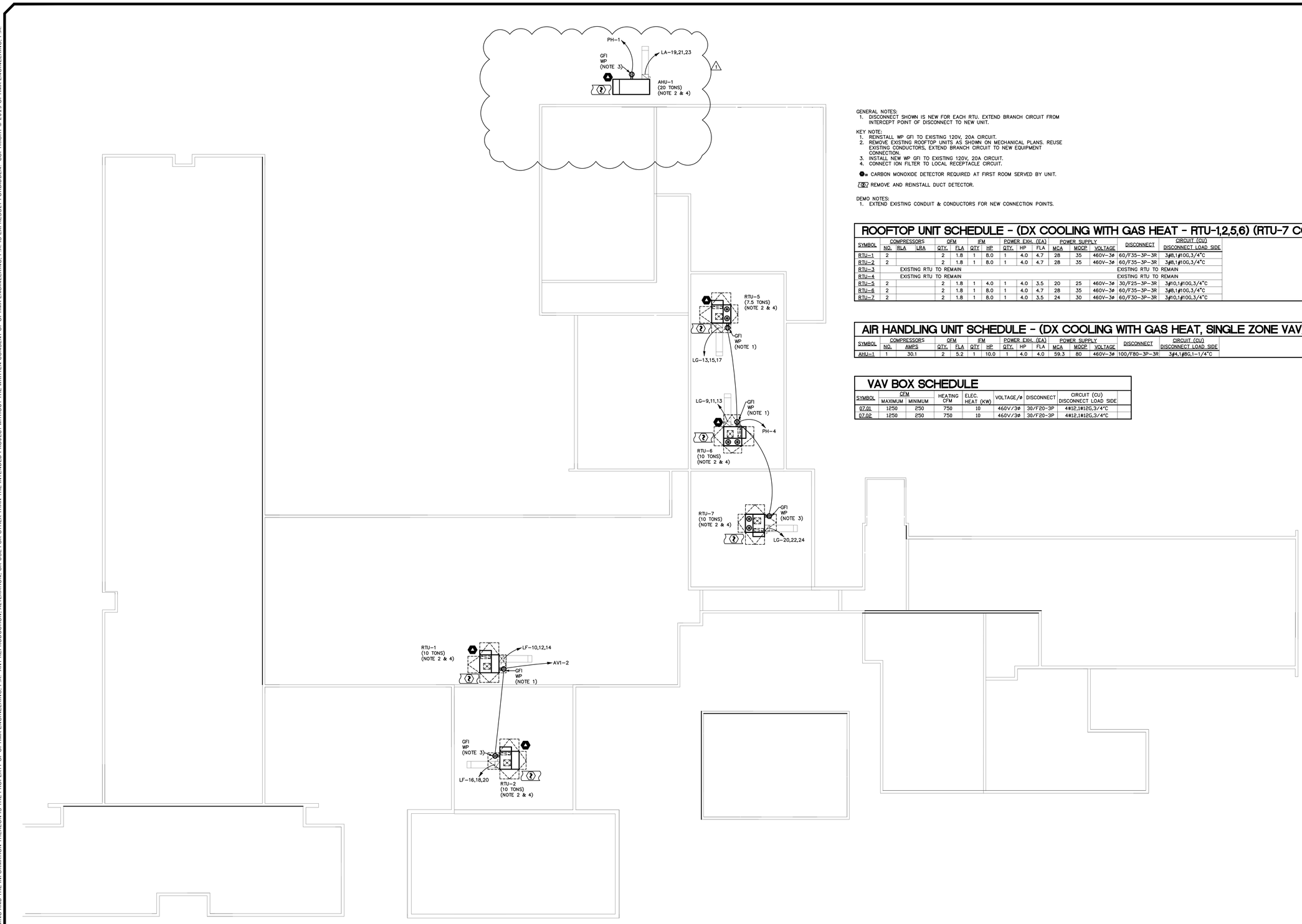
DUE DATE: **2:00 p.m., January 10, 2024**

Contractor shall fulfill all requirements listed within the bid documents, including additions and changes noted below.

Revise: Bid Due Date has been extended to 2:00 p.m., January 10, 2024.

Attachments: Revised Drawings E202, M01, M02, M11, M21, M22, M32, M41, S101

End of Addendum



GENERAL NOTES:
1. DISCONNECT SHOWN IS NEW FOR EACH RTU. EXTEND BRANCH CIRCUIT FROM INTERCEPT POINT OF DISCONNECT TO NEW UNIT.

KEY NOTE:
1. REINSTALL WP GFI TO EXISTING 120V, 20A CIRCUIT.
2. REMOVE EXISTING ROOFTOP UNITS AS SHOWN ON MECHANICAL PLANS. REUSE EXISTING CONDUCTORS, EXTEND BRANCH CIRCUIT TO NEW EQUIPMENT CONNECTION.
3. INSTALL NEW WP GFI TO EXISTING 120V, 20A CIRCUIT.
4. CONNECT ION FILTER TO LOCAL RECEPTACLE CIRCUIT.

(CO) CARBON MONOXIDE DETECTOR REQUIRED AT FIRST ROOM SERVED BY UNIT.

(07) REMOVE AND REINSTALL DUCT DETECTOR.

DEMO NOTES:
1. EXTEND EXISTING CONDUIT & CONDUCTORS FOR NEW CONNECTION POINTS.

ROOFTOP UNIT SCHEDULE - (DX COOLING WITH GAS HEAT - RTU-1,2,5,6) (RTU-7 COOLING ONLY)

SYMBOL	COMPRESSORS			OFM		IFM		POWER EXH. (EA)			POWER SUPPLY			DISCONNECT	CIRCUIT (CU)
	NO.	RLA	LRA	QTY.	FLA	QTY.	HP	QTY.	HP	FLA	MCA	MOCP	VOLTAGE		DISCONNECT LOAD SIDE
RTU-1	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3ø8,1ø10G,3/4"C
RTU-2	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3ø8,1ø10G,3/4"C
RTU-3	EXISTING RTU TO REMAIN													EXISTING RTU TO REMAIN	
RTU-4	EXISTING RTU TO REMAIN													EXISTING RTU TO REMAIN	
RTU-5	2			2	1.8	1	4.0	1	4.0	3.5	20	25	460V-3ø	30/F25-3P-3R	3ø10,1ø10G,3/4"C
RTU-6	2			2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	60/F35-3P-3R	3ø8,1ø10G,3/4"C
RTU-7	2			2	1.8	1	8.0	1	4.0	3.5	24	30	460V-3ø	60/F30-3P-3R	3ø10,1ø10G,3/4"C

AIR HANDLING UNIT SCHEDULE - (DX COOLING WITH GAS HEAT, SINGLE ZONE VAV)

SYMBOL	COMPRESSORS		OFM		IFM		POWER EXH. (EA)			POWER SUPPLY			DISCONNECT	CIRCUIT (CU)
	NO.	AMPS	QTY.	FLA	QTY.	HP	QTY.	HP	FLA	MCA	MOCP	VOLTAGE		DISCONNECT LOAD SIDE
AHU-1	1	30.1	2	5.2	1	10.0	1	4.0	4.0	59.3	80	460V-3ø	100/F80-3P-3R	3ø4,1ø8G,1-1/4"C

VAV BOX SCHEDULE

SYMBOL	CFM		HEATING CFM	ELEC. HEAT (KW)	VOLTAGE/ø	DISCONNECT	CIRCUIT (CU) DISCONNECT LOAD SIDE
	MAXIMUM	MINIMUM					
07.01	1250	250	750	10	460V/3ø	30/F20-3P	4#12,1#12G,3/4"C
07.02	1250	250	750	10	460V/3ø	30/F20-3P	4#12,1#12G,3/4"C

1 ELECTRICAL ROOF PLAN - NEW WORK
1/16" = 1'-0"

KEYPLAN

Mechanical • Electrical • Plumbing
Fire Protection • Techology Design
1927 S. Tryon St., Suite 300, Charlotte NC 28203
150 Fayetteville St., Suite 520, Raleigh, NC 27601
Phone (704) 910-1116 www.optima-eng.com
North Carolina License Number C-0914
optima engineering

SEAL:
NORTH CAROLINA PROFESSIONAL SEAL 034464 ENGINEER BRIAN E. THOMPSON
11-6-23

wesley chapel elementary school
ROOFTOP UNIT REPLACEMENT
110 potter road
monroe, nc 28110

REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: SMT
DESIGNED BY: SMT
CHECKED BY: MAM

SHEET TITLE:
ELECTRICAL ROOF PLAN

DWG #:
E202

SHEET NO: 5 of 6

MECHANICAL LEGEND

SYMBOL	DESCRIPTION	ABBR.
------ DTS ------	EX DUAL TEMP WATER SUPPLY	DTS
------ DTR ------	EX DUAL TEMP WATER RETURN	DTR
——— G ———	NATURAL GAS PIPING	G
——— D ———	CONDENSATE DRAIN	D
	GAS COCK	
	PRESSURE REDUCING/REGULATING VALVE	
	SOLENOID VALVE	
T	THERMOSTAT / TEMP SENSOR (4'-0" AFF TO TOP)	
H	HUMIDISTAT (4'-0" AFF TO TOP)	
C02	C02 DETECTOR (4'-0" AFF TO TOP)	
	SUPPLY AIR DIFFUSER (4-WAY)	
	RETURN AIR GRILLE	
	DOUBLE LINE DUCTWORK	
	SINGLE LINE DUCTWORK	
	EXISTING DOUBLE LINE DUCTWORK	
	EXISTING SINGLE LINE DUCTWORK	
	EXISTING DUCTWORK TO BE REMOVED	
20/14ø	20"x14" FLAT OVAL DUCT	
20x14	20"x14" RECTANGULAR DUCT	
8"ø	8" DIAMETER ROUND DUCT	
DD	DUCT MOUNTED SMOKE DETECTOR W/ ACCESS DOOR	
	POINT OF EXISTING TO NEW CONNECTION	
	POINT OF DEMOLITION TO EXISTING	
M.C.	MECHANICAL CONTRACTOR	
E.C.	ELECTRICAL CONTRACTOR	
P.C.	PLUMBING CONTRACTOR	
N.I.C.	NOT IN CONTRACT	
EX	EXISTING	
AFF	ABOVE FINISHED FLOOR	
DN	DOWN	
UP	UP	

COMMISSIONING NOTE - 2018 NCECC C408

UNION COUNTY PUBLIC SCHOOLS WILL PROVIDE A THIRD PARTY COMMISSIONING AGENT, RESPONSIBLE FOR SYSTEM COMMISSIONING PER 2018 NCECC SECTION C408. TO PERFORM THE COMMISSIONING DUTIES DESCRIBED IN SECTION C408, AND PROVIDE THE OWNER AND CODE OFFICIAL WITH A SEALED STATEMENT OF COMPLETION (APPENDIX C1). THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH COMMISSIONING AGENT AND PROVIDE ALL NECESSARY TIME, MATERIALS, AND PROCEDURES REQUIRED FOR A FULLY COMMISSIONED PROJECT.

DRAWING LIST

2018 NORTH CAROLINA ENERGY CONSERVATION CODE

COMMERCIAL ENERGY EFFICIENCY - MECHANICAL SUMMARY

C401 METHOD OF COMPLIANCE

- ■ 2018 NCECC CHAPTER 4
- ☐ ASHRAE 90.1-2013 PRESCRIPTIVE
- ☐ ASHRAE 90.1-2013 PERFORMANCE
- ☐ N/A (EXISTING LIGHTING, HVAC, AND DOM. WATER HEATING SYSTEMS TO REMAIN)
- ☐ COMCHECK PROVIDED (2018 NCECC)
- ☐ COMCHECK PROVIDED (90.1-2013)
- ☐ ENERGY MODELING DATA PROVIDED

C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

- ☐ C406.2 EFFICIENT MECH EQUIPMENT
- ☐ C406.3 REDUCED LTG DENSITY
- ☐ C406.4 ENHANCED LTG CONTROLS
- ☐ C406.5 ON-SITE RENEWABLE ENERGY
- ☐ C406.6 DEDICATED OA SYSTEM
- ☐ C406.7 SERVICE WATER HEATING
- ■ N/A EQUIPMENT REPLACEMENT ONLY (RTU-1,2,5,6, AHU-1)

C301 CLIMATE ZONE

3A - UNION COUNTY, NORTH CAROLINA

DESIGN CONDITIONS

EXTERIOR (ASHRAE 90.1-2013 TABLE D-1)

winter dry bulb	18° F.
summer dry bulb	91° F.
summer wet bulb	74° F.

INTERIOR (2018 NCECC SECTION C302.1)

winter dry bulb	72° F.
summer dry bulb	75° F.

C403.2 HEATING & COOLING LOADS AND EQUIPMENT & SYSTEM SIZING

BUILDING HEATING LOAD	EXISTING
BUILDING COOLING LOAD	EXISTING
INSTALLED HEATING CAPACITY	REFER TO SCHEDULES
INSTALLED COOLING CAPACITY	REFER TO SCHEDULES

C403.2.3 & C406.2 - REQUIRED & INCREASED HVAC EQUIPMENT PERFORMANCE

SYSTEM DESCRIPTION - REPLACEMENT OF EXISTING ROOFTOP UNITS WITH GAS/DX ROOFTOPS (TYPICAL OF 5) SEE SCHEDULES

- ■ MINIMUM HVAC EQUIP EFFICIENCY COMPLIANCE - TABLE C403.2.3
- ☐ INCREASED HVAC EQUIP EFFICIENCY COMPLIANCE - 10% OVER TABLE C403.2.3

EQUIP TYPE	SIZE CATEGORY (BTUH)	SUBCATEGORY	C403.2.3 MINIMUM EFFICIENCY (a)	10% INCREASED EFF. (a)	DESIGN EFFIC.
TABLE C403.2.3(1) - UNITARY AIR CONDITIONERS AND CONDENSING UNITS					
AIR COND, AIR COOLED	>= 65,000 & < 135,000	SPLIT SYSTEM & SINGLE PACKAGE	11.2 EER 12.8 IEER	12.3 EER 14.1 IEER	SEE SCHEDULE

a. DEDUCT 0.2 FROM THE REQUIRED EERS AND IEERS FOR UNITS WITH A HEATING SECTION OTHER THAN ELECTRIC RESISTANCE HEAT OR NO HEAT.

C403.2.4 THRU C403.2.11

■ HVAC SYSTEMS ARE FULLY COMPLIANT WITH THE REQUIREMENTS FOR HVAC SYSTEM CONTROL, VENTILATION, ENERGY RECOVERY, DUCT AND PLENUM INSULATION AND SEALING, PIPING INSULATION, AND SYSTEM COMPLETION.

C403.2.12 - AIR SYSTEM DESIGN AND CONTROL

- ☐ ALL FANS INSTALLED ON THE PROJECT ARE 5 HP OR LESS AND ARE EXEMPT FROM THESE REQUIREMENTS.
- ■ FANS ABOVE 5 HP MEET THE CFM LIMITATIONS SHOWN BELOW:

OPTION 1 - FAN SYSTEM MOTOR NAMEPLATE HP - TABLE C403.2.12.1(1)

ALLOWABLE NAMEPLATE MOTOR HP	CONSTANT VOLUME MINIMUM CFM	VARIABLE VOLUME MINIMUM CFM	DESIGN CFM
10	9,091 CFM	6,667 CFM	SEE SCHEDULE

C403.3 - ECONOMIZERS (PRESCRIPTIVE)

- ■ PROJECT INCLUDES AN AIR OR WATER ECONOMIZER COMPLIANT WITH C403.3
- ☐ PROJECT MEETS AN ECONOMIZER EXCEPTION LISTED IN C403.3

C403.4 - HYDRONIC AND MULTIPLE-ZONE HVAC SYSTEMS CONTROL AND EQUIPMENT (PRESCRIPTIVE)

- ■ PROJECT CONSISTS OF ONLY SINGLE ZONE DX SYSTEMS, EXEMPT FROM THE PRESCRIPTIVE REQUIREMENTS OF C403.4.
- ☐ PROJECT CONSISTS OF HVAC SYSTEMS FULLY COMPLIANT WITH THE PRESCRIPTIVE REQUIREMENTS OF C403.4.

C405.8 - ELECTRICAL MOTORS (MANDATORY REQUIREMENTS).

- ■ ELECTRICAL MOTORS HAVE BEEN SPECIFIED TO MEET MINIMUM EFFICIENCY REQUIREMNTS PER C405.8, EXCEPT WHERE EXEMPT.
- ☐ NOT APPLICABLE.

C408 - SYSTEM COMMISSIONING

- ☐ BUILDING IS LESS THAN 10,000 SQUARE FEET AND IS EXEMPT FROM THE SYSTEM COMMISSIONING REQUIREMENTS OF SECTION C408.
- ■ BUILDING IS GREATER THAN 10,000 SQUARE FEET AND REQUIRES SYSTEM COMMISSIONING PER SECTION C408.

EQUIVALENT MANUFACTURERS LISTING

LISTING OF MANUFACTURER'S NAME DOES NOT GUARANTEE APPROVAL. ALL EQUIPMENT MUST MEET OR EXCEED QUALITY AND CAPACITIES OF SPECIFIED EQUIPMENT. FINAL APPROVAL WILL BE BASED ON EQUIPMENT SUBMITTALS. ANY MANUFACTURER NOT LISTED BUT WISHING TO BID THIS PROJECT SHALL SUBMIT A WRITTEN REQUEST A MINIMUM OF 7 DAYS PRIOR TO BID DATE OR AS INDICATED IN THE SPECIFICATIONS, PRIOR APPROVAL IS REQUIRED FOR ALL MANUFACTURERS NOT LISTED.

(ALPHABETICAL ORDER)

PACKAGED ROOFTOP UNITS (UNDER 25 TONS): CARRIER, TRANE, DAIKIN

AIR DISTRIBUTION: CARNES, METAL*AIRE, NAILOR, PRICE, TITUS, KRUEGER

DDC CONTROLS: EXISTING FRONT END: TRIDIUM
NEW JACE: N4 TRIDIUM
NEW CONTROLLERS: VANGUARD 32 (BACNET OVER IP)

VAV TERMINAL UNITS: CARRIER, ENVIRO-TEC, NAILOR, PRICE, TITUS, TRANE

NOTE:
ALL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.

MECHANICAL GENERAL NOTES

SEE SPECIFICATIONS FOR ADDITIONAL PROJECT REQUIREMENTS. THESE GENERAL NOTES ARE INTENDED TO SUPPLEMENT THE SPECIFICATIONS. IN THE EVENT THAT THE VERBIAGE IS IN CONFLICT OR CONTRADICTS THE REQUIREMENTS LISTED HERE, THE QUESTION SHALL BE ASKED PRIOR TO BIDDING OR THE MORE STRINGENT SHALL APPLY AT THE ENGINEER'S DISCRETION.

1. DO NOT SCALE DRAWINGS. SEE ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATION OF DOORS, WINDOWS, CEILING DIFFUSERS, ETC.
2. ALL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. THIS INCLUDES ANY MODIFICATIONS TO ANY ASSOCIATED MECHANICAL, PLUMBING, OR ELECTRICAL SYSTEMS REQUIRED BY THIS SPECIFIC MANUFACTURER'S INSTALLATION INSTRUCTIONS.
3. ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL CONSTRUCTED IN ACCORDANCE WITH THE LATEST SMACNA STANDARDS. ALL SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK SHALL INSULATED AS PER SPECIFICATIONS
4. ALL DUCTWORK SHALL BE SEALED PER THE REQUIREMENTS OF THE **NORTH CAROLINA** INTERNATIONAL MECHANICAL CODE. REFER TO MECHANICAL SPECIFICATIONS.
5. ALL PIPING, DUCTS, VENTS, ETC., EXTENDING THROUGH WALLS AND ROOF SHALL BE FLASHED AND COUNTERFLASHED IN A WATERPROOF MANNER.
6. ALL PIPING AND DUCTWORK LOCATIONS SHALL BE COORDINATED WITH THE WORK UNDER OTHER DIVISIONS OF THE SPECIFICATIONS, TO AVOID INTERFERENCE.
7. UPON PROJECT COMPLETION, THE MECHANICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE OWNER INSTALLATION INFORMATION INCLUDING RECORD SUBMITTALS (WITH ANY SUBMITTAL REVIEW COMMENTS ADDRESSED) AND O&M MANUALS FOR EACH PIECE OF EQUIPMENT INCLUDING ALL SELECTED OPTIONS, THE NAME AND ADDRESS OF AT LEAST ONE SERVICE AGENCY, FULL CONTROL SYSTEM O&M AND CALIBRATION INFORMATION INCLUDING WIRING DIAGRAMS, SCHEMATICS, FULL SEQUENCE OF OPERATION, AND PROGRAMMED SETPOINTS.
8. PROVIDE A ONE YEAR WARRANTY FOR ALL WORK PERFORMED BEGINNING ON THE DAY THE SYSTEM IS COMPLETELY OPERATIONAL AND ACCEPTABLE BY THE OWNER.
9. PROVIDE MANUFACTURER'S RECOMMENDED CLEARANCES AROUND ALL EQUIPMENT FOR MAINTENANCE AND FILTER REMOVAL.
10. CONDENSATE DRAIN PIPING SHALL BE PROVIDED AS PER SPECIFICATIONS.
11. ANY DEVICE REQUIRING A THERMOSTAT FOR CONTROL SHALL BE FURNISHED WITH A THERMOSTAT WHETHER INDICATED ON THE DRAWINGS OR NOT.
12. INSTALL THE TOP OF ALL THERMOSTATS, SENSORS, AND SWITCHES AT 4'-0" (MAXIMUM) ABOVE FINISH FLOOR. COORDINATE EXACT THERMOSTAT LOCATION WITH OWNER PRIOR TO INSTALLATION.
13. CONTRACTOR SHALL VERIFY LOCATION OF ALL EXISTING TO BE DEMOLISHED ROOF PENETRATIONS (DUAL TEMP PIPING) WORK. PATCHING OF EXISTING ROOF PENETRATIONS MADE THROUGH EXISTING ROOF SYSTEMS SHALL BE VERIFIED WITH THE OWNER'S EXISTING ROOF WARRANTY PRIOR TO WORK.
14. EXISTING ROOF CURBS SHALL BE MEASURED AND VERIFIED THRU ROOFTOP UNIT VENDOR AND CONRACTOR. NEW CURB ADAPTORS SHALL BE FABRICATED TO MATE WITH EXISTING ROOF CURBS.
15. CONTRACTOR SHALL VERIFY ALL NEW ROOFTOP UNITS OUTSIDE AIR INTAKES MAINTAIN A MINIMUM OF 10'-0" FROM ANY EXISTING EXHAUST FANS OR FLUE.
16. REFER TO SPECIFICATIONS FOR GAS PIPING MATERIALS AND INSTALLATION.
17. REFER TO SPECIFICATIONS FOR DUAL TEMPERATURE PIPING INSULATION, PIPE MATERIALS, VALVING, ETC. .
18. ALL EQUIPMENT CONCRETE PAD SIZES FOR MECHANICAL EQUIPMENT SHALL BE CONFIRMED WITH APPROVED SHOP DRAWING SUBMITTALS AND ASSOCIATED UNIT MANUFACTURER ANCHOR LOCATIONS PRIOR TO FABRICATION/INSTALLATION. THE MECHANICAL AND PLUMBING CONTRACTORS SHALL COORDINATE THE EXACT LOCATION OF MECHANICAL EQUIPMENT HOUSEKEEPING PADS WITH THE FLOOR DRAIN LOCATIONS PRIOR TO INSTALLATION OF DRAINS AT EQUIPMENT/PAD LOCATIONS.
19. DUCTWORK AND PIPING PASSING THROUGH/ABOVE ELECTRICAL ROOMS SHALL BE CLOSELY COORDINATED WITH THE ELECTRICAL CONTRACTOR. DUCTWORK OR PIPING SHALL NOT BE LOCATED ABOVE ELECTRICAL PANELS.
20. EQUIPMENT OPERATED DURING CONSTRUCTION SHALL USE FILTERED MEDIA TO PREVENT CONSTRUCTION DEBRIS FROM ENTERING COILS, DUCTWORK SYSTEMS, AIR TERMINALS ETC. AT COMPLETION OF CONSTRUCTION, MECHANICAL CONTRACTOR SHALL CLEAN ALL SYSTEMS WITH ALL CONTROL DEVICES WIDE OPEN AND REMOVE ANY REMAINING DEBRIS PRIOR TO TEST AND BALANCING. MECHANICAL CONTRACTOR SHALL REPLACE ALL FILTRATION WITH NEW FILTERS AT COMPLETION OF CONSTRUCTION. ANY DUCTWORK, AIR TERMINALS, AND/OR OTHER EQUIPMENT UPSTREAM OF FILTRATION SHALL BE CLEANED THOROUGHLY OF CONSTRUCTION DEBRIS BEFORE HANDING OVER TO OWNER.
21. ALL MECHANICAL EQUIPMENT SHALL BE U.L. LISTED AND LABELED AS A COMPLETE PACKAGE, NOT THROUGH INDIVIDUAL COMPONENTS OR PARTS. PROVIDE REQUIRED 3RD PARTY FIELD UL LISTING SERVICES AS REQUIRED TO COMPLY.

MECHANICAL DEMOLITION NOTES

1. THE MECHANICAL CONTRACTOR SHALL VISIT SITE PRIOR TO BEGINNING WORK TO DETERMINE THE LEVEL OF DEMOLITION REQUIRED AND INCLUDE ALL NECESSARY PRICING IN THEIR BID.
2. IT IS THE MECHANICAL CONTRACTORS RESPONSIBILITY TO FIELD VERIFY ALL EXISTING DUCTWORK AND PIPING. ANY DISCREPANCIES BETWEEN EXISTING CONDITIONS AND MECHANICAL PLANS SHOULD BE BROUGHT TO THE ATTENTION OF THE MECHANICAL ENGINEER.
3. THE MECHANICAL CONTRACTOR SHALL FIELD VERIFY ALL EXISTING FIRE DAMPERS ARE LOCATED WHERE INDICATED ON DRAWINGS. ALL NEW AND EXISTING DUCTWORK PENETRATING NEW RATED WALLS SHALL BE PROVIDED WITH A 1½-HOUR (TYPE-B) FIRE DAMPER WHETHER INDICATED ON PLANS OR NOT.
4. M.C. SHALL VERIFY ALL EXISTING SUPPLY AND RETURN AIR DUCT TO REMAIN IS INSULATED WITH VAPOR BARRIER INTACT. IF EXISTING DUCT IS NOT INSULATED WITH EITHER DUCT LINER OR WRAP, M.C. SHALL PROVIDE 2" THICK DUCT WRAP WITH VAPOR BARRIER (MIN. R-VALUE OF 5.0).
5. FOR ALL EXISTING HVAC EQUIPMENT AND DUCTWORK NOTED TO REMAIN AND SERVING AREA OF RENOVATION, MECHANICAL CONTRACTOR SHALL INSPECT EQUIPMENT (AND ANY ASSOCIATED CONTROLS, VALVES, DAMPERS, ETC.) TO VERIFY PROPER WORKING ORDER. MECHANICAL CONTRACTOR TO SERVICE AND CLEAN EXISTING HVAC UNITS TO ENSURE DESIGN AIRFLOW AND COOLING/HEATING CAPACITIES ARE OBTAINED. ANY EQUIPMENT FOUND TO BE INOPERABLE OR SHORT OF DESIGN CAPACITIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROJECT COMPLETION. PROVIDE CLEAN FILTERS IN ALL UNITS AT COMPLETION OF PROJECT. DAMAGED DUCTWORK SHALL BE REPAIRED.

VENTILATION CALCULATIONS (NCMC 2018, SECT 403):

OCCUPANCY CLASSIFICATION	PEOPLE O/A RATE IN BREATHING ZONE (CFM/PERSON)	AREA O/A RATE IN BREATHING ZONE (CFM/SQ. FT.)	DEFAULT OCCUPANCY DENSITY (PEOPLE/1000 SQ. FT.)	AREA (SQ. FT.)	CALCULATED OCCUPANCY (PEOPLE)	CALCULATED PEOPLE O/A (CFM)	CALCULATED AREA O/A (CFM)
CLASSROOMS (AGES 5-8)	7.500000	0.000000	25	2,100	53	394	0
			BLDG TOTAL OUTSIDE AIR REQ'D (Ez=0.8, CFM)			492	
			BUILDING TOTAL OUTSIDE AIR PROVIDED (CFM)			RTU-7 = 500CFM	

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11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL SCHEDULES, NOTES, SYMBOLS AND LEGEND

DWG #:
M0.1

SHEET NO: 1 OF 10

ROOFTOP UNIT SCHEDULE - (DX COOLING WITH GAS HEAT - RTU-1,2,5,6) (RTU-7 COOLING ONLY)

SYMBOL	CFM	NOMINAL TONNAGE	OUTSIDE AIR MINIMUM (CFM)	E.S.P.	COOLING CAPACITY TC (BTUH)	COOLING CAPACITY SHC (BTUH)	EFFICIENCY EER	EFFICIENCY IEER	HEATING CAPACITY INPUT (BTUH)	HEATING CAPACITY OUTPUT (BTUH)	EFFICIENCY AFUE	COMPRESSORS NO.	COMPRESSORS RLA	COMPRESSORS LRA	OFM QTY.	OFM FLA	IFM QTY.	IFM HP	POWER EXH. (EA) QTY.	POWER SUPPLY HP	POWER SUPPLY FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP	POWER SUPPLY VOLTAGE	OPERATING WEIGHT	ACCESSORIES	SYSTEM TYPE	MANUFACTURER DAIKIN MODEL
RTU-1	3,500	10	875*/175**	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-2	3,500	10	875*/175**	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-3	EXISTING RTU TO REMAIN																										EXISTING RTU TO REMAIN	
RTU-4	EXISTING RTU TO REMAIN																										EXISTING RTU TO REMAIN	
RTU-5	2,500	7.5	625*/125**	1.0"	93,000	67,000	12.1	19.8	200,000	160,000	80%	2	SEE NOTE "B"		2	1.8	1	4.0	1	4.0	3.5	20	25	460V-3ø	2,182 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,R,S,T	SINGLE ZONE VAV	DPS007A
RTU-6	3,500	10	875*/175**	1.0"	123,000	89,000	12.5	18.8	200,000	160,000	80%	2	SEE NOTE "A"		2	1.8	1	8.0	1	4.0	4.7	28	35	460V-3ø	2,407 LBS	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T	SINGLE ZONE VAV	DPS010A
RTU-7	2,500	7.5	500*/125**	2.0"	93,000	67,000	12.1	19.8	N/A	N/A	N/A	2	SEE NOTE "B"		2	1.8	1	8.0	1	4.0	3.5	24	30	460V-3ø	2,071 LBS	A,B,C,D,E,F,G,H,I,J,K,N,O,P,R,S	DUCT PRESSURE CONTROL	DPS007A

COMPRESSOR NOTES:

A. COMPRESSOR #1: 4.5 AMPS; COMPRESSOR #2: 7.9 AMPS

B. COMPRESSOR #1: 5.4 AMPS; COMPRESSOR #2: 3.9 AMPS

NOTES:

1. COOLING CAPACITIES BASED ON 95° AMBIENT, 80/67 ENTERING AIR.
2. ALL UNITS SHALL BE AGA CERTIFIED, U.L. LABELED, AND ASHRAE 90.1 COMPLIANT.
3. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR; INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR. SMOKE DETECTOR SHALL BE INSTALLED IN THE RETURN DUCT BY THE MECHANICAL CONTRACTOR.
4. PRIMARY COOLING COIL DRAIN PAN SHALL BE PROVIDED WITH A FLOAT SWITCH BY UNIT MFR; ACTIVATION OF THE FLOAT SWITCH SHALL SHUT DOWN UNIT AND SEND AN ALARM TO THE CENTRAL BAS.
5. INTEGRATE INTO EXISTING BAS (REVISE SEQUENCE PER SHEET M004), PROVIDE DDC TEMP/HUMIDITY SENSORS TO REPLACE EXISTING THERMOSTATS AT SAME LOCATION (N/A RTU-7).

* DESIGN OUTSIDE AIRFLOW (CFM)
** OCCUPIED MINIMUM OUTSIDE AIRFLOW (CFM), REFER TO CO2 CONTROL ON SEQUENCE OF OPERATIONS.

ION FILTER REQUIREMENTS:

PROVIDE RTU'S WITH AN ION FILTER AS MANUFACTURED BY GLOBAL PLASMA SOLUTIONS INDICATED BELOW
MODEL # GPS-FC48-AC 120V COMPATIBLE
INSTALL (1) FILTER PER 4,800 CFM

ION FILTER NOTES:

1. FILTER SHALL BE UL-2998 RATED.
2. PROVIDE WITH INTEGRAL BAS ALARM CONTACTS.
3. PROVIDE WITH WEATHER TIGHT ENCLOSURE.

ACCESSORIES:

A - ROOF CURB ADAPTOR (FIT NEW UNIT TO EX CURB)
B - PERMANENT METAL FILTER FRAMES WITH REPLACEABLE FILTERS
C - VARIABLE SPEED DIRECT DRIVE SUPPLY FAN
D - DUAL COMPRESSORS #1 INVERTER, #2 FIXED
E - COMPARATIVE ENTHALPY ECOMOMIZER
F - VERTICAL DRAW THROUGH
G - 2" PLEATED FILTERS (MERV-8 MINIMUM)
H - LOW AMBIENT CONTROLS
I - UNIT CASING CONSTRUCTED OF ZINC COATED GALVANIZED STEEL.
J - CO2 SENSOR FOR DEMAND LIMITING CONTROL (BY BAS)
K - INTERNAL VIBRATION ISOLATION
L - MODULATING GAS HEAT (5:1 TURNDOWN)
M - ON/OFF HOT GAS REHEAT
N - STAINLESS STEEL COOLING COIL DRAIN PAN
O - CONDENSER COIL HAIL GUARDS
P - SINGLE POINT ELECTRICAL CONNECTION
Q - CONVENIENCE OUTLET
R - POWER EXHAUST FAN
S - GPS BI-POLAR IONIZATION FILTER (SEE NOTE THIS PAGE)
T - PROVIDE NEW TEMPERATURE/HUMIDITY SPACE SENSOR LOCATE IN SAME LOCATION AS EXISTING, FIELD VERIFY

AHU-1 ACCESS PLATFORMS:

AHU-1 WILL REQUIRE THE USE OF A BOTTOM CURB ADAPTOR. INSTALLATION OF A BOTTOM DISCHARGE CURB ADAPTOR WILL REQUIRE A GRATED ACCESS PLATFORM ALONG SERVICE SIDE OF UNIT. SEE BELOW FOR ACCESS PLATFORM SPECIFICATIONS.

DESIGN: SERVICE PLATFORMS WILL BE FACTORY DESIGNED AND FITTED ON AHU BOTTOM DISCHARGE PLENUM. BASIS OF DESIGN: MGM PRODUCTS OR APPROVED EQUAL

MAIN BASE FRAME:

a. 14ga STEEL FOLDED INTO A MODIFIED "C" WITH INTERIOR PROTRUDING SUPPORT FOR TREAD PLATES.
b. MUST INCLUDE WELDED MOUNTING CUPS FOR HANDRAILS.
c. PRE-PUNCHED MOUNTING HOLES AND WATER WEEP HOLES IN ENTIRE BASE OF PERIMETER.
d. FRAMES MUST BE FULLY WELDED AND ALL WELDS COATED WITH ZINC-RICH PRIMER: SSPC-PAINTED 20 TYPE II.
e. SYSTEM WILL BE BROKEN INTO BOLT ON SECTIONS SO AS NOT TO EXCEED 10 FEET IN LENGTH TO ALLOW EASY MANEUVERABILITY AND INSTALLATION.
f. BASE FRAMES WILL HAVE FULLY ADJUSTABLE BRACES FOR LEVELING. BRACES WILL MOUNT TO THE CURB.
g. FRAME WILL BE POWDER COATED WITH EXTERIOR GRADE POLYESTER POWDER, BAKED ON AT 400 DEGREES. MINIMUM COATING THICKNESS OF .030 MIL.

TREAD PLATES:

a. 14ga STEEL DOUBLE BROKE AND BOX FOLDED TO CREATE A RIGID WALKING SURFACE.
b. THREAD PLACE MUST BE FACTORY PUNCHED AND FORMED TO CREATE A NON-SLIP SURFACE. (EXPANEDED METAL WILL NOT BE ALLOWED).
c. THREAD PLATES WILL BE REMOVABLE AND WILL NOT EXCEED 12" SECTIONS FOR EASE OF REMOVAL.
d. EDGES WILL BE COATED WITH ZINC-RICH PRIMER: SSPC-PAINT 20 TYPE II.

RAILING:

a. 14ga GALVANIZED 1.625" DIAMETER TUBING.
b. 42" TALL TOPRAIL, 21" TALL MIDRAIL AND 4" TALL TOE KICK TO MEET OSHA STANDARDS.
c. HANDRAILS MUST ALSO BE REMOVABLE.
d. RAILING WILL BE POWDER COATED GLOSS BLACK WITH EXTERIOR GRADE POLYESTER POWDER, BAKED ON AT 400 DEGREES. MINIMUM COATING THICKNESS OF 030 MIL.

1

AIR HANDLING UNIT SCHEDULE - (DX COOLING WITH GAS HEAT, SINGLE ZONE VAV)

SYMBOL	CFM	NOMINAL TONNAGE	OUTSIDE AIR MINIMUM (CFM)	E.S.P.	COOLING CAPACITY TC (BTUH)	COOLING CAPACITY SHC (BTUH)	EFFICIENCY EER	EFFICIENCY IEER	HEATING CAPACITY INPUT (BTUH)	HEATING CAPACITY OUTPUT (BTUH)	EFFICIENCY AFUE	COMPRESSORS NO.	COMPRESSORS AMPS	OFM QTY.	OFM FLA	IFM QTY.	IFM HP	POWER EXH. (EA) QTY.	POWER SUPPLY HP	POWER SUPPLY FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP	POWER SUPPLY VOLTAGE	OPERATING WEIGHT	ACCESSORIES	MANUFACTURER DAIKIN MODEL
AHU-1	8,000	20	1500*/400**	1.0"	265,000	205,000	10.1	18.6	450,000	360,000	80%	1	30.1	2	5.2	1	10.0	1	4.0	4.0	59.3	80	460V-3ø	3833 LBS	SEE BELOW	DPS020A

NOTES:

1. COOLING CAPACITIES BASED ON 95° AMBIENT, 80/67 ENTERING AIR.
2. ALL UNITS SHALL BE AGA CERTIFIED, U.L. LABELED, AND ASHRAE 90.1 COMPLIANT.
3. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR; INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR. SMOKE DETECTOR SHALL BE INSTALLED IN THE RETURN DUCT BY THE MECHANICAL CONTRACTOR.
4. PRIMARY COOLING COIL DRAIN PAN SHALL BE PROVIDED WITH A FLOAT SWITCH BY UNIT MFR; ACTIVATION OF THE FLOAT SWITCH SHALL SHUT DOWN UNIT AND SEND AN ALARM TO THE CENTRAL BAS.
5. INTEGRATE INTO EXISTING BAS (REVISE SEQUENCE PER SHEET M005), PROVIDE DDC THERMODISTAT, REPLACE EXISTING THERMOSTATS AT SAME LOCATION.

* DESIGN OUTSIDE AIRFLOW (CFM)
** OCCUPIED MINIMUM OUTSIDE AIRFLOW (CFM), REFER TO CO2 CONTROL ON SEQUENCE OF OPERATIONS.

ACCESSORIES:

A - PERMANENT METAL FILTER FRAMES WITH REPLACEABLE FILTERS
B - VARIABLE SPEED DIRECT DRIVE PLENUM SUPPLY FAN (SINGLE ZONE VAV)
1 C - MODULATING CONTROL WITH INVERTER COMPRESSOR
D - BOTTOM DISCHARGE/INTAKE PLENUM
E - 2" PLEATED FILTERS (MERV-8 MINIMUM)
F - UNIT CASING CONSTRUCTED OF ZINC COATED GALVANIZED STEEL.
G - CO2 SENSOR FOR DEMAND LIMITING CONTROL (BY BAS)
H - INTERNAL VIBRATION ISOLATION
I - 4-STAGE GAS HEATING
J - ON/OFF HOT GAS REHEAT
K - STAINLESS STEEL COOLING COIL DRAIN PAN
L - CONDENSER COIL HAIL GUARDS
M - POWER EXHAUST FAN
N - COMPARATIVE ENTHALPY ECONOMIZER
O - LOW AMBIENT CONTROLS
P - CONVENIENCE OUTLET

VAV BOX SCHEDULE

SYMBOL	CFM MAXIMUM	CFM MINIMUM	HEATING CFM	RUNOUT SIZE	ELEC. HEAT (KW)	VOLTAGE/ø	PRICE SDV	REMARKS
7-1	1250	250	750	14"ø	10	460V/3ø	12	SEE BELOW
7-2	1250	250	750	14"ø	10	460V/3ø	12	SEE BELOW

NOTES:

1. MINIMUM INLET PRESSURE TO TERMINAL UNITS SHALL BE 0.75" W.G.
2. MAXIMUM PRESSURE DROP THROUGH TERMINAL UNITS SHALL BE 0.25" S.P.
3. FURNISH BOXES WITH: DDC CONTROLS, ACOUSTICAL LINING, FILTER AND FRAME, DDC TEMP SENSOR THERMOSTAT, CONTROL VOLTAGE TRANSFORMER, ELECTRIC HEAT, U.L. LABEL, ELECTRONIC DUCT SENSOR FOR MORNING WARM-UP.
4. ELECTRIC HEATER SHALL BE FURNISHED WITH DISCONNECT SWITCH, MAGNETIC CONTACTORS, AIRFLOW SWITCH, MANUAL RESET THERMAL CUTOUT.
5. PROVIDE SCR CONTROLLERS ON ALL BOXES (1 - 10 VDC).
6. DDC CONTROLS SHALL BE FURNISHED TO THE BOX MANUFACTURER BY THE CONTROLS VENDOR. BOX MANUFACTURER SHALL FACTORY MOUNT AND WIRE CONTROLS. INSTALLATION OF CONTROLS SHALL INCLUDE CONTROLS TRANSFORMER, FAN RELAY, HEAT RELAY, AIR FLOW PROBE, CONTROL COVER, AND ALL WIRING AND LABOR FOR A COMPLETE AND OPERATIONAL SYSTEM.

GRILLE AND DIFFUSER SCHEDULE

SYMBOL	SERVICE	CFM RANGE	FACE SIZE (*)	NECK SIZE	TYPE	OBD	PRICE
A	SUPPLY	250	24x24	12x12	LOUVERED	NO	SMD
B	RETURN	1000	24x24	22x22	FIXED BLADE	NO	530
C	RETURN	6500	NK + FACE	SEE DWGS	FIXED BLADE	YES	95

1

(*) - FOR DEVICES INSTALLED IN GYP CEILINGS, PROVIDE MINIMUM FACE SIZE FOR SPECIFIED NECK SIZE.

NOTES:

1. ALL CEILING AND WALL MOUNTED DEVICES SHALL BE FURNISHED WITH AN ENAMEL OFF-WHITE FINISH.
2. ALL DEVICES SHALL BE FURNISHED WITH FRAMES SUITABLE FOR TYPE OF INSTALLATION REQUIRED.
3. TYP-B AND C: 3/4" BLADE SPACING AT 45 DEGREE DEFLECTION. TYPE-C: FULLY WELDED, HEAVY DUTY STEEL CONSTUCTION (GYM APPLICATION)

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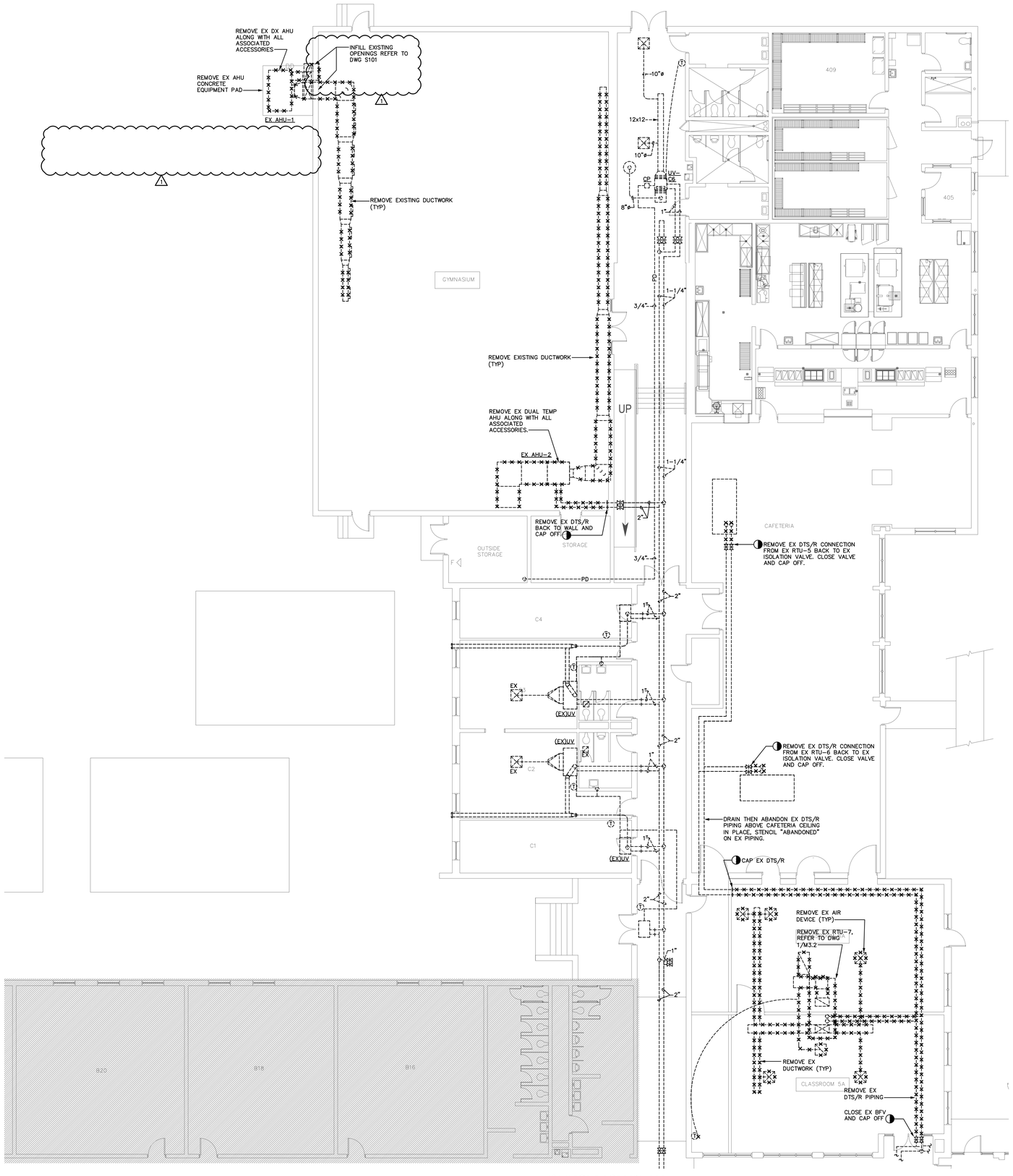
REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

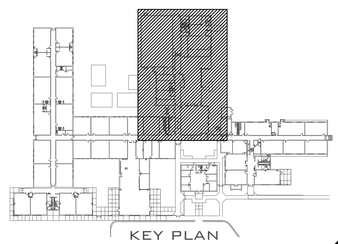
SHEET TITLE:
MECHANICAL SCHEDULES

DWG #:
M0.2

SHEET NO: 2 OF 10



1 DEMOLITION PLAN
1/8" = 1'-0"



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REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

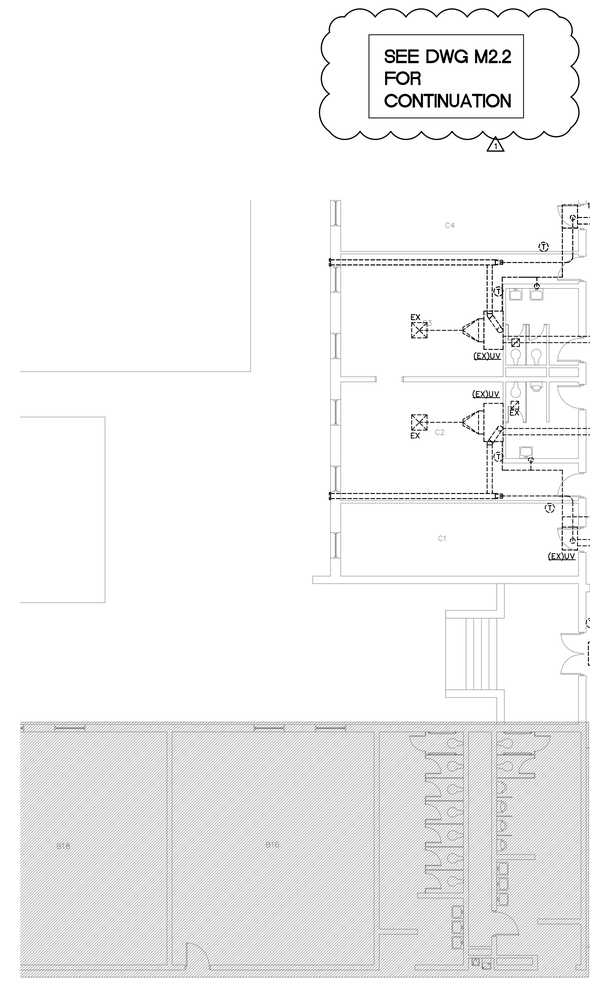
DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL - DEMOLITION PLAN

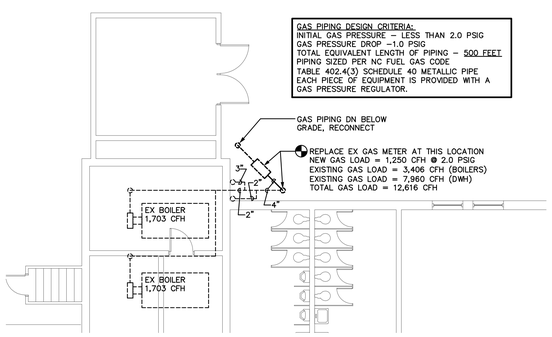
DWG #:
M1.1

SHEET NO: 5 OF 10

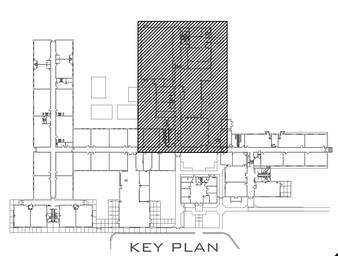
SEE DWG M2.2 FOR CONTINUATION



1 MECHANICAL FLOOR PLAN
1/8" = 1'-0"



2 MECHANICAL FLOOR PLAN - GAS PIPING
1/8" = 1'-0"



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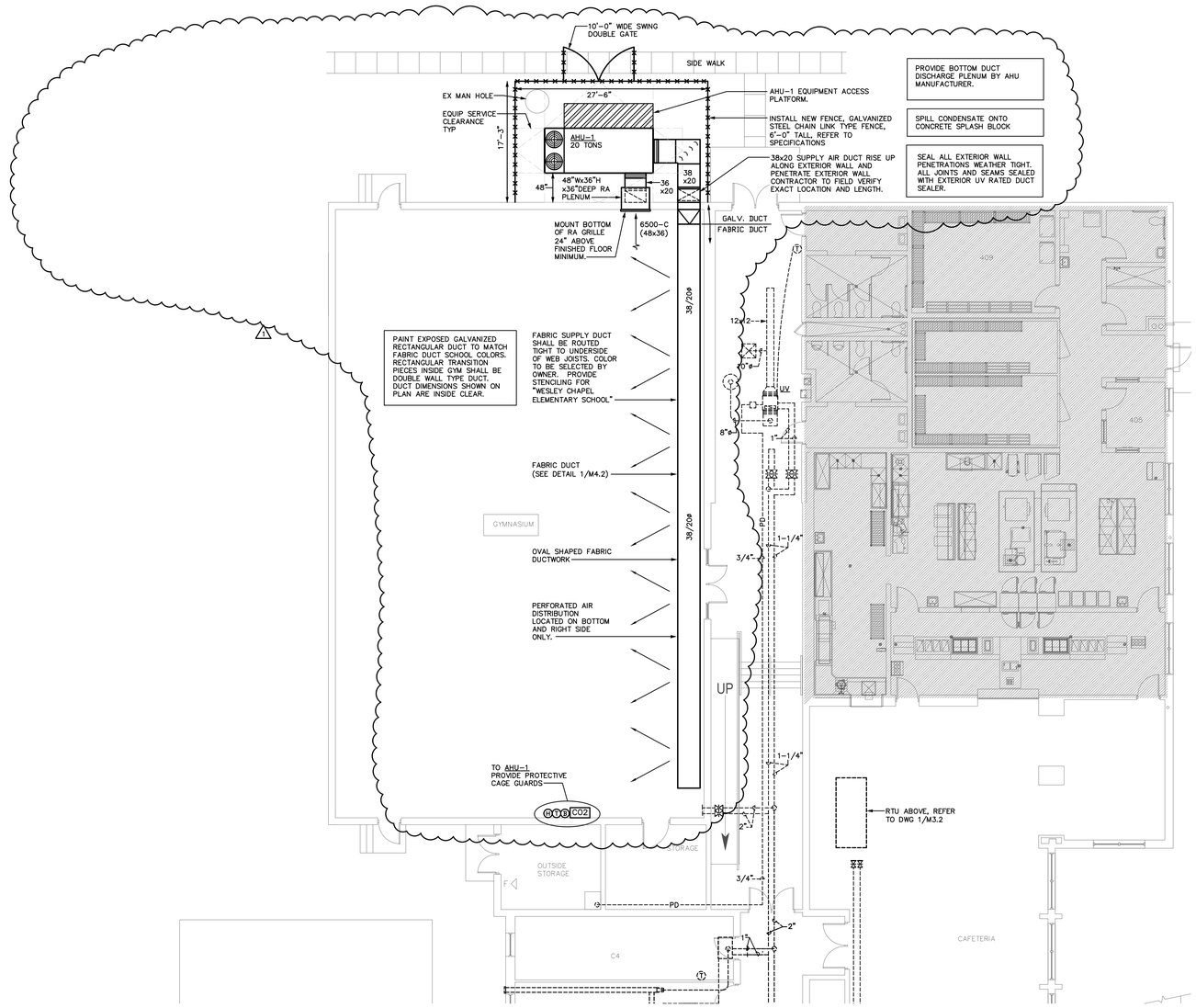
REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

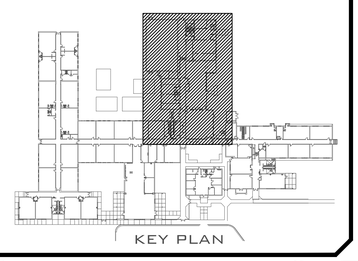
SHEET TITLE:
MECHANICAL FLOOR PLAN - NEW WORK

DWG #:
M2.1

SHEET NO: 6 OF 10



1 MECHANICAL FLOOR PLAN
1/8" = 1'-0"



KEY PLAN

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

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ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

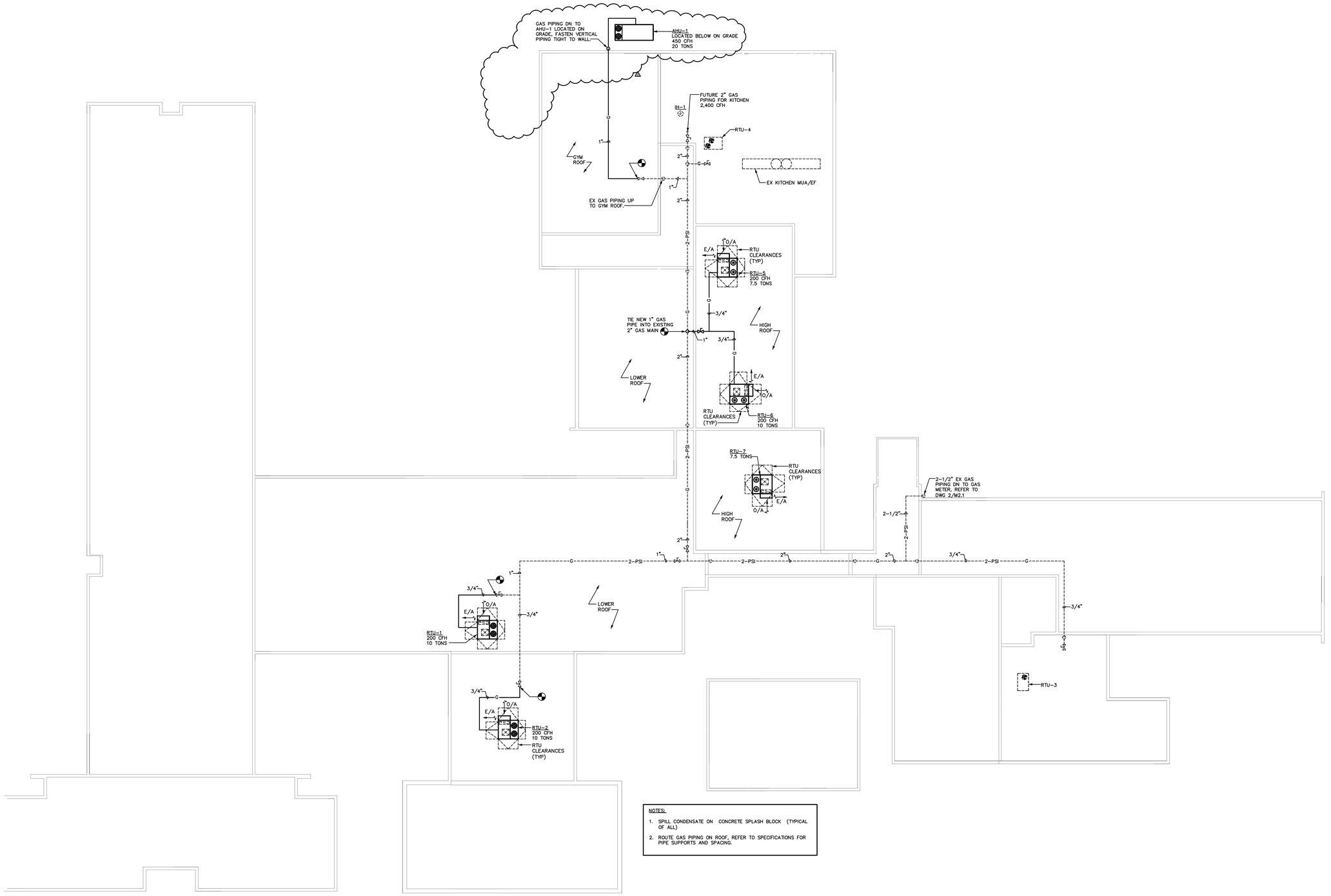
REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL FLOOR PLAN - NEW WORK

DWG #: M2.2

SHEET NO: 1 6 OF 11



NOTES:

1. SPILL CONDENSATE ON CONCRETE SPLASH BLOCK (TYPICAL OF ALL)
2. ROUTE GAS PIPING ON ROOF, REFER TO SPECIFICATIONS FOR PIPE SUPPORTS AND SPACING.

1 MECHANICAL ROOF PLAN

1/16" = 1'-0"

MECHANICAL • ELECTRICAL • PLUMBING
FIRE PROTECTION • TECHOLOGY DESIGN

1927 S. TRYON ST., SUITE 300, CHARLOTTE NC 28203
150 FAYETTEVILLE ST., SUITE 520, RALEIGH, NC 27601
PHONE: (704) 333-1952 FAX: (704) 333-1953 WWW.OPTIMAENGINEERING.COM
NORTH CAROLINA LICENSE NUMBER C-1391-4

optima engineering

SEAL:

NORTH CAROLINA PROFESSIONAL SEAL 027892 ENGINEER STEVEN R. DALEY
11-6-23

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

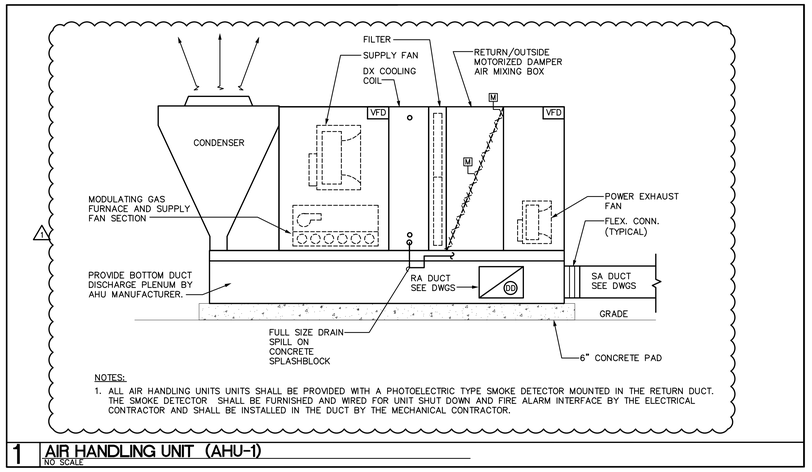
REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL ROOF PLAN NEW WORK

DWG #:
M3.2

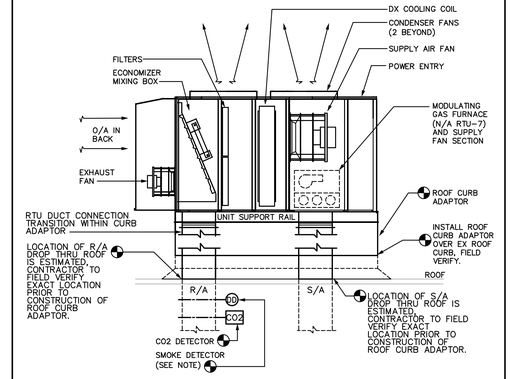
SHEET NO: 8 OF 10



NOTES:

1. ALL AIR HANDLING UNITS UNITS SHALL BE PROVIDED WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR MOUNTED IN THE RETURN DUCT. THE SMOKE DETECTOR SHALL BE FURNISHED AND WIRED FOR UNIT SHUT DOWN AND FIRE ALARM INTERFACE BY THE ELECTRICAL CONTRACTOR AND SHALL BE INSTALLED IN THE DUCT BY THE MECHANICAL CONTRACTOR.

1 AIR HANDLING UNIT (AHU-1)
NO SCALE



NOTES:

1. SEE PLANS FOR SIZE AND ROUTING OF DUCTWORK AND PIPING.
2. PROVIDE EACH UNIT WITH A PHOTOELECTRIC TYPE SMOKE DETECTOR, INSTALLED IN THE RETURN DUCT WIRED TO SHUT DOWN THE UNIT UPON ACTIVATION. SMOKE DETECTOR SHALL BE SUPPLIED, WIRED FOR INTERFACE WITH FIRE ALARM SYSTEM AND UNIT SHUTDOWN BY THE ELECTRICAL CONTRACTOR.SMOKE DETECTOR SHALL BE INSTALLED IN THE EXHAUST DUCT BY THE MECHANICAL CONTRACTOR.

2 ROOFTOP UNIT DETAIL (RTU-1,2,5,6,7)
NO SCALE

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FIRE PROTECTION • TECHNOLOGY DESIGN
1927 S. TRYON ST., SUITE 300, CHARLOTTE NC 28203
150 FAYETTEVILLE ST., SUITE 520, RALEIGH, NC 27601
PHONE (704) 375-1399 FAX (704) 375-1335 WWW.OPTIMAENG.COM
NORTH CAROLINA LICENSE NUMBER C-1914
optima engineering

SEAL:

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT

110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION
1	1-2-24	ADDENDUM-1

DATE: 11-06-2023
PROJECT #: 23-0271
DRAWN BY: JMF
DESIGNED BY: JMF
CHECKED BY: SRD

SHEET TITLE:
MECHANICAL EQUIPMENT DETAILS

DWG #:
M4.1

SHEET NO: 9 OF 10

GENERAL NOTES

1.0. CODES AND STANDARDS:

1.1. NORTH CAROLINA STATE BUILDING CODE 2018 EDITION INCLUDING ALL SUBSEQUENT SUPPLEMENTS AND AMENDMENTS THERETO.

1.2. "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES", AMERICAN SOCIETY OF CIVIL ENGINEERS, ASCE 7-10.

1.3. "SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS", PUBLICATION 360-10 BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, AND AS AMENDED IN SPECIFICATIONS.

1.4. "STRUCTURAL WELDING CODE – STEEL (AWS D1.1-10)" AND "STRUCTURAL WELDING CODE REINFORCING STEEL (AWS D1.4-11)", AMERICAN WELDING SOCIETY.

1.5. "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE (ACI 318-14)", AMERICAN CONCRETE INSTITUTE AND ALL SUCCEEDING REVISIONS.

1.6. "MANUAL OF STANDARD PRACTICE", CONCRETE REINFORCING STEEL INSTITUTE, LATEST EDITION.

2.0. STRUCTURAL STEEL:

2.1. ALL STRUCTURAL STEEL SHALL BE OF THE GRADES INDICATED BELOW, UNLESS NOTED OTHERWISE ON PLANS OR DETAILS:

A. OTHER ROLLED SHAPES ASTM A36 TYPICALLY, U.N.O.
B. ANCHOR BOLTS ASTM F1554 GR36 U.N.O.
C. PLATES AND BARS ASTM A36 U.N.O.
D. MISCELLANEOUS ASTM A36 U.N.O.

2.2. ALL STRUCTURAL STEEL SHALL BE DETAILED AND, FABRICATED IN ACCORDANCE WITH THE AISC CODE OF STANDARD PRACTICE AS MODIFIED IN THESE NOTES AND THE PROJECT SPECIFICATIONS.

2.3. SUBMIT SHOP DRAWINGS FOR DETAILS, FABRICATION, AND ERECTION OF STRUCTURAL STEEL. COMPLY WITH AISC "STEEL CONSTRUCTION MANUAL", AISC "DETAILING FOR STEEL CONSTRUCTION", AND AISC "ENGINEERING FOR STEEL CONSTRUCTION" PUBLICATIONS.

2.4. SHOP DRAWINGS SHALL BE REVIEWED BY THE CONTRACTOR PRIOR TO SUBMISSION. DRAWINGS SHALL BEAR THE CONTRACTOR'S APPROVAL STAMP ACCEPTING RESPONSIBILITY FOR DIMENSIONS, QUANTITIES AND COORDINATION WITH THE OTHER TRADES.

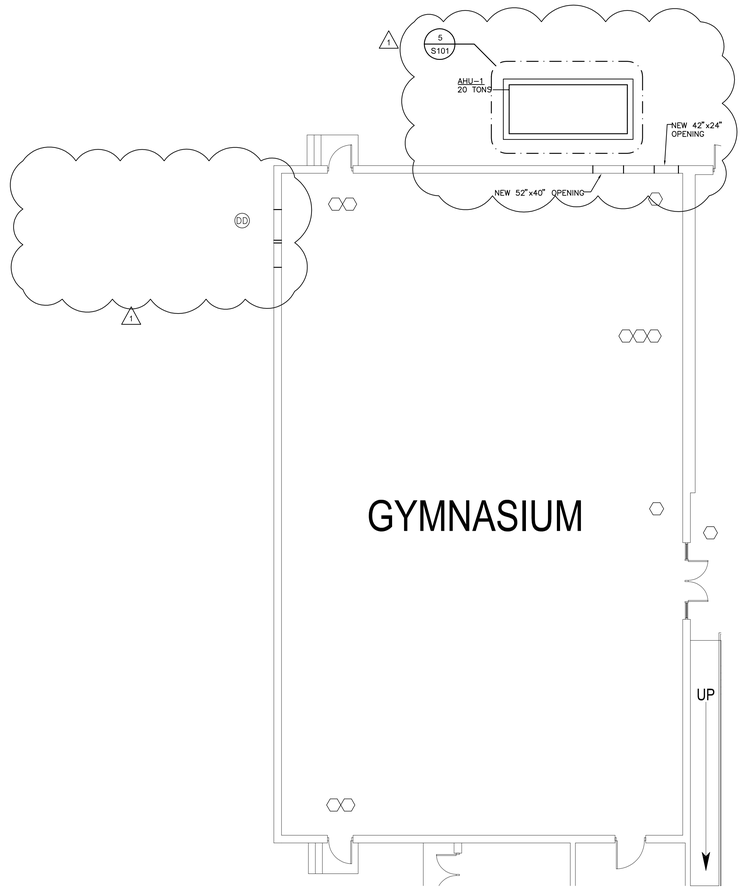
2.5. DRAWINGS MAY BE ELECTRONICALLY SUBMITTED, PROVIDED LEGIBILITY IS MAINTAINED. REVIEW COMMENTS ONLY WILL BE ELECTRONICALLY FORWARDED TO THE CONTRACTOR.

2.6. CONTRACTOR SHALL PROVIDE IN HIS SCHEDULE FOR A SHOP DRAWING REVIEW AND RETURN TIME OF A MINIMUM OF FIFTEEN (15) WORKING DAYS IN THE STRUCTURAL ENGINEER'S OFFICE.

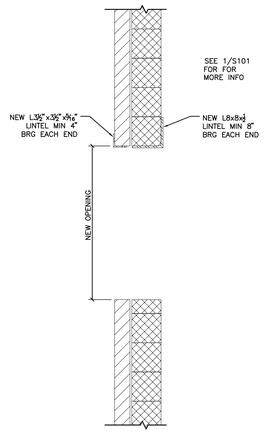
2.7. SPLICING OF STEEL MEMBERS, UNLESS SHOWN ON THE DRAWINGS, IS PROHIBITED WITHOUT WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER.

2.8. NO CHANGE IN SIZE OR POSITION OF ANY STRUCTURAL ELEMENT NOR HOLES, SLOTS, CUTS, ETC. SHALL BE MADE UNLESS DETAILED AND NOTED AS A PROPOSED CHANGE ON THE SHOP DRAWINGS AND REVIEWED AND ACCEPTED BY THE STRUCTURAL ENGINEER.

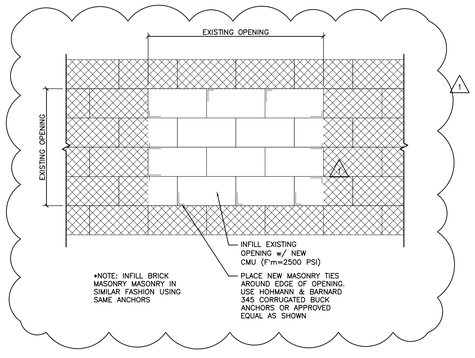
2.9 ALL EXPOSED STEEL TO BE HOT-DIPPED GALVANIZED.



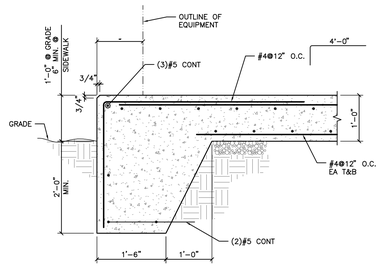
1 S101 SITE PLAN
1/8" = 1'-0"



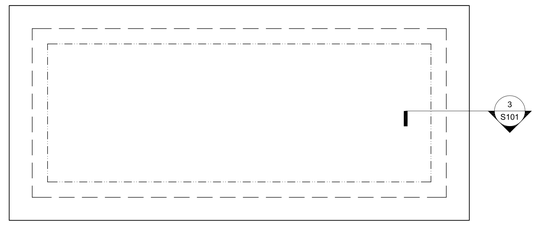
2 S101 SECTION @ NEW OPNG
1/4" = 1'-0"



3 S101 INFILL OF EXISTING OPENINGS
1/4" = 1'-0"



4 S101 SECTION
3/4" = 1'-0"



5 S101 EQUIPMENT PAD
1/4" = 1'-0"

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optima engineering
1927 S. Tryon St., Suite 300, Charlotte NC 28203
150 E. Sutton Pl., Suite 210, Greenville SC 29615
PHONE: 704-338-1292 WWW.OPTIMAENGINEERING.COM
North Carolina License Number C-0914

SEAL: NC COA# C-1088

NORTH CAROLINA PROFESSIONAL SEAL 15464 ENGINEER MARK STEVEN RICHER 2-JAN-24

WESLEY CHAPEL ELEMENTARY SCHOOL
ROOFTOP UNIT REPLACEMENT
110 POTTER ROAD
MONROE, NC 28110

REV #	DATE	DESCRIPTION
1	01-02-24	ADDENDUM 1

DATE: 11-06-2023
PROJECT #: 21-0271
DRAWN BY: RES
DESIGNED BY: MSR
CHECKED BY: MSR

SHEET TITLE:
STRUCTURAL PLAN AREA-A

DWG #:
S101

SHEET NO: OF

UCPS
UNION COUNTY PUBLIC SCHOOLS
Purchasing and Contract Division

201 Venus Street
Monroe, NC 28112
Phone 704.296.6320 Fax 704.283.2371
www.ucps.k12.nc.us

ADDENDUM 3

PROJECT: **Wesley Chapel Elementary School-Rooftop Unit Replacements (HVAC)**
4-97380026

DUE DATE: **2:30 p.m., February 22, 2024**

Contractor shall fulfill all requirements listed within the bid documents, including additions and changes noted below.

This project is considered a rebid.

Bid Date and Time has been changed to 2:30 p.m., February 22, 2024.

End of Addendum

UNION COUNTY PUBLIC SCHOOLS

201 Venus Street
Monroe, NC 28112
Phone 704.296.6320
www.ucps.k12.nc.us

ADDENDUM: 4

PROJECT: **Wesley Chapel Elementary School-Rooptop Unit Replacements (HVAC)**
4-97380026

DUE DATE: **2:30 p.m., February 22, 2024**

Contractor shall fulfill all requirements listed within the bid documents, including additions and changes noted below.

Questions:

1. Does the circuit feeding the existing AHU that is shown to be reconnected need to be upsized for the new AHU?
   Answer: For bidding purposes, the existing circuit is planned to be reconnected. If needed, the upsizing cost will be applied to the allowance Funds.

2. What fire alarm vendor do we need to price reconnecting the duct detectors to the existing FACP?
   Answer: Fire Alarm Vendor is Carolina Fire Technologies, Brad Rippetoe, 704.997.9569.

Additional Information:

Contractors shall coordinate any roof penetrations with the manufacturer under warranty. Roof Warranty Documentations are attached.

End of Addendum

004.01

003.05
INST 8/20/2014
EXP 8/20/2034

003.07
INST 11/24/2008
EXP 11/24/2028

003.11
INST 8/6/2008
EXP 8/6/2028

007.01

INST 11/24/2008
EXP 11/24/2028

003.09

003.10
INST 2/4/2016
EXP 2/4/2036

006.01

005.01

003.08
INST 2/4/2016
EXP 2/4/2036

008.01

003.03
INST 8/20/2014
EXP 8/20/2034

009.01

002.04
INST 8/20/2014
EXP 8/20/2034

003.02
INST 8/20/2014
EXP 8/20/2034

003.06
INST 8/20/2014
EXP 8/20/2034

002.03
INST 8/20/2014
EXP 8/20/2034

002.02
INST 8/20/2014
EXP 8/20/2034

002.05
INST 8/20/2014
EXP 8/20/2034

003.01
INST 8/20/2014
EXP 8/20/2034

002.01
INST 8/20/2014
EXP 8/20/2034

002.06
INST 8/20/2014
EXP 8/20/2034

003.04
INST 8/20/2014
EXP 8/20/2034

001.01
INST 8/20/2014
EXP 8/20/2034

003.12
INST 8/6/2008
EXP 8/6/2028

003.13
INST 8/6/2008
EXP 8/6/2028

LEGEND

CURB	LADDER	PITCH PAN	SCUPPER
VENT/STACK	STAIRS	SCUTTLE	MAIN ENTRANCE
ROOF DRAIN	ROOF DRAIN	COLLECTOR	SAMPLE
SLEEPER			

REV.	DATE	DRAFT	DESIGN	QC1	FINAL
1					
2					
3					

NH&A has made every effort to represent the correct existing conditions with this drawing. Field adjustments may be required due to unknown existing conditions.

WESLEY CHAPEL ELEMENTARY SCHOOL

Nelson Hall & Associates Roof Consulting Services
1001-C Lancaster Ave., Monroe, NC 28112 704/282-0826 FAX 704/289-6956

Date: 2017

Union County School System
Wesley Chapel Elementary School
Monroe, North Carolina

Drawing No.: 48

Union County Public Schools
Roof Area Information Chart

SCHOOL	ROOF AREA	COMPLETION DATE	ROOFING MANUFACTURER	EXPIRATION DATE	MEMBRANE TYPE	MAUNFACTURER PHONE	ROOFING COMPANY	WARRANTY #	FBPCO#
Wesley Chapel Elementary	01.01	8/20/2014	x		Metal	x	AAR	x	
Wesley Chapel Elementary	02.01	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.02	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.03	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.04	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.05	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.06	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	02.07	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.01	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.02	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.03	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.04	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.05	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.06	8/20/2014	Firestone- 20 yr.	8/20/2034	Modified Bitumen	(800) 428-4442	AAR	RO068497	IG0073
Wesley Chapel Elementary	03.07	11/24/2008	Siplast- 20yr.	11/24/2028	Modified Bitumen	(469) 995-2200	Cyclone Roofing	37007	
Wesley Chapel Elementary	03.08	2/4/2016	GAF - 20 yr.	2/4/2036	Modified Bitumen	(800) 766- 3411	Piedmont Commercial	G2016-00000730	
Wesley Chapel Elementary	03.09	11/24/2008	Siplast- 20yr.	11/24/2028	Modified Bitumen	(469) 995-2200	Cyclone Roofing	37007	
Wesley Chapel Elementary	03.10	2/4/2016	GAF - 20 yr.	2/4/2036	Modified Bitumen	(800) 766-3411	Piedmont Commercial	G2016-00000730	
Wesley Chapel Elementary	03.11	8/6/2008	Carlisle -20yr.	8/6/2028	PVC	800-233-0551	Piedmont Commercial	CMD 1026032	
Wesley Chapel Elementary	03.12	8/6/2008	Carlisle -20yr.	8/6/2028	PVC	800-233-0551	Piedmont Commercial	CMD 1026032	
Wesley Chapel Elementary	03.13	8/6/2008	Carlisle -20yr.	8/6/2028	PVC	800-233-0551	Piedmont Commercial	CMD 1026032	
Wesley Chapel Elementary	04.01				MCR				
Wesley Chapel Elementary	05.01				MCR				
Wesley Chapel Elementary	06.01				MCR				
Wesley Chapel Elementary	07.01				MCR				
Wesley Chapel Elementary	08.01				Concrete/Utility				
Wesley Chapel Elementary	09.01				Shingle/Storage				

MCR = Mobile Classroom

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Phone 704.296.6320 Fax 704.283.2371
www.ucps.k12.nc.us

ADDENDUM 5

PROJECT: **Wesley Chapel Elementary School-Rooftop Unit Replacements (HVAC)**
4-97380026

DUE DATE: **2:30 p.m., February 27, 2024**

Contractor shall fulfill all requirements listed within the bid documents, including additions and changes noted below.

Bid Extended to 2:30 p.m., February 27, 2024. All other requirements remain in place.

Revise Answer to Addendum 3, Question 1 as follows:
Contractor is to include in the bid amount to provide and install a new 80A/3P breaker in panel LB, circuit LB-2,4,6. 3#4,1#8G,1 1/4"C. Existing AHU-1 circuit to become spare.

End of Addendum

COST PROPOSAL/EXECUTION OF PROPOSAL

Wesley Chapel Elementary School
Rooftop Unit Replacement (HVAC)
BID NO. 4-97380026

By submitting this proposal, the potential contractor certifies the proposal is signed by an authorized representative of the firm.

The cost and availability of all equipment, materials, and supplies associated with performing the services described herein have been determined and included in the proposed cost.

All labor costs, direct and indirect, **sales tax, etc.** have been determined and included in the proposed cost.

The offeror is aware of prevailing conditions associated with performing these services.

The potential contractor has read and understands the conditions set forth in this bid and agrees to them with no exceptions.

Therefore, in compliance with this Request for Proposals, and subject to all conditions herein, the undersigned offers and agrees, if this proposal is accepted within **60** days from the date of the opening, to furnish the subject services for a cost not to exceed:

BASE BID (ROOFTOP UNITS)	$ 708,186.00	180 *CCD
ALTERNATE 1 (AIR HANDLING UNIT)	$ 111,679.00	180 *CCD
ALTERNATE 2 (VAV BOXES)	$ 12,389.00	90 *CCD
ALLOWANCE FUNDS	$ 20,000.00	
ALL INCLUSIVE TOTAL	$ 852,254.00	180 *CCD

*CCD: Consecutive Calendar Days required to achieve Final Completion from issuance of Notice to Proceed

ADDENDA ACKNOWLEDGEMENT

ADDENDUM 1: ✓ ADDENDUM 2: ✓ ADDENDUM 3: ✓

Addendum 4: ✓ Addendum 5: ✓

EXECUTION

OFFEROR: EZ Mechanical LLC. FEDERAL ID NO. 30-0021918

LICENSE DESCRIPTION: Mechanical LICENSE NO. 10296

ADDRESS: 4933 Brookshire Blvd. CITY, STATE, ZIP Charlotte, NC 28216

TELEPHONE NUMBER: 980-365-7615 MOBILE: _____ EMAIL: bids@ezmechanical.com

BY: [signature] (Signature) DATE: 2/27/2024 TITLE: President

Katherine C Early
(Typed or printed name)

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of Mecklenburg

Affidavit of EZ Mechanical LLC. (Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- [X] **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- [X] **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- [X] **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- [ ] **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- [X] **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- [ ] **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- [X] **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- [ ] **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- [ ] **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- [ ] **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: 2/21/24 Name of Authorized Officer: Katherine C. Early

Signature: Katherine C Early

Title: President

COLLEEN PETERMAN NOTARY PUBLIC SEAL MECKLENBURG COUNTY, NC My Commission Expires 10/13/2028

State of North Carolina, County of Mecklenburg

Subscribed and sworn to before me this 21 day of February 2024

Notary Public

My commission expires 10.13.2028

Document A310™ – 2010

Conforms with The American Institute of Architects AIA Document 310

Bid Bond

CONTRACTOR:
(Name, legal status and address)

E2 Mechanical, LLC
4933 Brookshire Blvd.
Charlotte, NC 28216

SURETY:
(Name, legal status and principal place of business)
Arch Insurance Company
Harborside 3, 210 Hudson Street Suite 300
Jersey City, NJ 07311-1107
Mailing Address for Notices
Same As Above

OWNER:
(Name, legal status and address)
Union County Public Schools

Monroe, NC

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.

BOND AMOUNT: 5% Five Percent of Amount Bid

PROJECT:
(Name, location or address, and Project number, if any)
Wesley Chapel Elementary School Rooftop Unit Replacements (HVAC)

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner 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. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this 22nd day of February, 2024.

(Witness)

E2 Mechanical, LLC
(Principal) *(Seal)*

By: _____
(Title)

(Witness) Jennifer Hoehn

Arch Insurance Company
(Surety) *(Seal)*

By: _____
(Title) Elizabeth D. Drum, Attorney-in-Fact

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Note, Loan, Letter of Credit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:
That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Elizabeth D. Drum

its true and lawful Attorney(s)in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed: Any and all bonds, undertakings, recognizances and other surety obligations, in the penal sum not exceeding One hundred and Fifty Million Dollars (150,000,000.00). Any and all bonds, undertakings, recognizances and other surety obligations.

Surety Bond Number: Bid Bond
Principal: E2 Mechanical, LLC
Obligee: Union County Public Schools

This authority does not permit the same obligation to be split into two or more bonds in order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on August 31, 2022, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"**VOTED**, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on August 31, 2022:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on August 31, 2022, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company. **In Testimony Whereof**, the Company has caused this instrument to be signed and its corporate seal to be affixed by their authorized officers, this 31st day of August, 2022

Attested and Certified

Regan A. Shulman, Secretary

Arch Insurance Company — Corporate Seal 1971 — Missouri

Arch Insurance Company

Stephen C. Ruschak, Executive Vice President

STATE OF PENNSYLVANIA SS
COUNTY OF PHILADELPHIA SS

I, **Michele Tripodi**, a Notary Public, do hereby certify that Regan A. Shulman and Stephen C. Ruschak personally known to me to be the same persons whose names are respectively as Secretary and Executive Vice President of the Arch Insurance Company, a Corporation organized and existing under the laws of the State of Missouri, subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that they being thereunto duly authorized signed, sealed with the corporate seal and delivered the said instrument as the free and voluntary act of said corporation and as their own free and voluntary acts for the uses and purposes therein set forth.

Commonwealth of Pennsylvania - Notary Seal
MICHELE TRIPODI, Notary Public
Philadelphia County
My Commission Expires July 31, 2025
Commission Number 1166632

Michele Tripodi, Notary Public
My commission expires 07/31/2025

CERTIFICATION

I, **Regan A. Shulman**, Secretary of the Arch Insurance Company, do hereby certify that the attached **Power of Attorney dated** August 31, 2022 on behalf of the person(s) as listed above is a true and correct copy and that the same has been in full force and effect since the date thereof and is in full force and effect on the date of this certificate; and I do further certify that the said Stephen C. Ruschak, who executed the Power of Attorney as Executive Vice President, was on the date of execution of the attached Power of Attorney the duly elected Executive Vice President of the Arch Insurance Company.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the Arch Insurance Company on this 22nd day of February, 2024.

Regan A. Shulman, Secretary

This Power of Attorney limits the acts of those named therein to the bonds and undertakings specifically named therein and they have no authority to bind the Company except in the manner and to the extent herein stated.

PLEASE SEND ALL CLAIM INQUIRIES RELATING TO THIS BOND TO THE FOLLOWING ADDRESS:
Arch Insurance – Surety Division
3 Parkway, Suite 1500
Philadelphia, PA 19102

Arch Insurance Company — Corporate Seal 1971 — Missouri

To verify the authenticity of this Power of Attorney, please contact Arch Insurance Company at SuretyAuthentic@archinsurance.com
Please refer to the above named Attorney-In-Fact and the details of the bond to which the power is attached.

Identification of HUB Certified/ Minority Business Participation

I, EZ Mechanical LLC.
(Name of Bidder)

do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)
R+F Insulation 4341 Triple Crown Dr. SW. Concord, NC	Pipe & Duct Insulation	MSBE	Y

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($) 11,207 92 .