KANSAS CITY KANSAS PUBLIC SCHOOLS

KANSAS CITY KANSAS PUBLIC SCHOOLS / USD 500

PURCHASING OFFICE | 2010 N. 59TH STREET ROOM 370 \ KANSAS CITY, KS 66104

WEB SITE: WWW.KCKPS.ORG/PURCHASING

RTU REPLACEMENT
(VARIOUS LOCATIONS)

BID NO: **IFB 21-006** **ISSUE DATE:** **MARCH 15, 2021**

Kansas City Kansas Public Schools will receive sealed bids, on this form at the Purchasing Office, 2010 N. 59th Street, Room 370, Kansas City, KS 66104 until **10:00 AM., March 31, 2021**, at which time bids received will be publicly opened and read, all in accordance with bid instructions, specifications and/or bid conditions attached hereto or as shown below.

Contact/Technical Contact:

Wayne C. Correll, Purchasing Manager | (913) 279-2270 | eMail: wayne.correll@kckps.org

BID INSTRUCTIONS:

FAXED BIDS WILL NOT BE ACCEPTED.

Kansas City Kansas Public Schools is temporarily accepting bids via email. No Faxed Bids will be accepted.

Until further notice, the Purchasing Office of the Kansas City Kansas Public Schools is closed to the public as a result of the COVID-19 restrictions. All public bid openings will be conducted via video conference call.

During this time all bids are to be submitted via UPS, FedEx or emailed to wayne.correll@kckps.org . All bids submitted must be received by the Purchasing Office by the specific bid closing date and time of 2:00PM Central Time. If emailed, it is the responsibility of the 'bidder' to ensure the bid date and time is met. FedEx and UPS currently deliver directly to the Central Office of the Kansas City Kansas Public Schools. Bids are not considered received until they are date and time stamped in the Purchasing Office. The Purchasing Office will not be responsible for late deliveries.

For questions regarding confirmation that your bid has been received by the Purchasing Office, please email Wayne Correll at wayne.correll@kckps.org.

The Public Bid Opening for this solicitation shall be opened in public via Zoom Video Conference Call at the hour stated in the notice at the below number:

KCKPS Purchasing Department is inviting you to a scheduled Zoom meeting.

Topic: **IFB 21-006 RTU Replacement – Various Locations**
Time: **Mar 31, 2021 10:00 AM Central Time (US and Canada)**

Join Zoom Meeting
https://us02web.zoom.us/j/84691332573?pwd=OFYwNEpNZEdRWHlneUptMS9PKzRLQT09

Meeting ID: 846 9133 2573
Passcode: 992021

One tap mobile
+12532158782,,84691332573# US (Tacoma)
+13462487799,,84691332573# US (Houston)

Dial by your location
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
+1 669 900 6833 US (San Jose)
+1 301 715 8592 US (Washington DC)
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)

Meeting ID: 846 9133 2573
Find your local number: https://us02web.zoom.us/u/kzbzX49Zw

A bid tabulation will be provided in response to an emailed request to wayne.correll@kckps.org .

Per attached specifications listed in this invitation to bid. Bidders must specify manufacturer/model number/delivery days, and unit price on each item or bid may be determined to be non-responsive.

- Pricing shall be FOB Kansas City, KS (freight and fuel expenses included).
- Award may be to more than one bidder.
- The District reserves the right to reject any or all bids, to waive any informalities, irregularities or technical defects in bids, and unless otherwise specified by the District to accept any item or groups of items in the bid, as may be in the best interest of the District.
- Time (days, weeks, etc.) required for delivery is a significant consideration with respect to this award process. The time required for delivery must be indicated in the space provided or your bid may be found non-responsive and may not be considered.
- Bid shall include copies of pertinent warranty information pertaining to the product offered. The bidder agrees that equipment furnished under any resultant purchase order issued by Kansas City Kansas Public Schools shall be covered by commercial warranties the contractor gives to any customer for such supplies. All warranty information and certificates shall be furnished and become the property of the District upon delivery and acceptance of said items and/or the contractor must honor services and all rights and remedies stated in the warranties.
- All items are new manufacture unless otherwise specifically stated in this bid.
- All products must have passed the first line quality standard as set by the manufacturer and no seconds, blemished articles or items having defective workmanship are included.
- Bidder shall notify the District immediately of any changes to specifications made by the manufacturer for the equipment listed.
- Bid may not be considered if a service charge, minimum dollar or minimum quantity order is applied.
- The outcome of this bid will be posted on the District's Purchasing site www.kckps.org/purchasing under Awards Section and will include a bid tabulation/summary.

- Bidder shall acknowledge all addenda for this bid and include the form acknowledgements with their bid.

Reference Attachment A for further Bid Conditions and Instructions

Overview:

The Kansas City Kansas Public Schools is seeking bids from qualified contractors for the replacement of existing rooftop units at the following District locations:

A. Bridges/Wyandot Academy – 3101 N. 10th St., Kansas City, KS 66104
B. Douglass Elementary – 1310 N. 9th St., Kansas City, KS 66101
C. Grant Elementary – 1510 N. 4th St., Kansas City, KS 66101
D. Lindbergh Elementary – 641 N. 57th St., Kansas City, KS 66102
E. New Stanley Elementary – 3604 Metropolitan Ave., Kansas City, KS 66104
F. Morse Early Childhood Center – 912 S. Baltimore St., Kansas City, KS 66105

Description:

The successful bidder(s), shall furnish all labor, equipment, and materials necessary to complete the removal of existing units and replace units per attached documents. The vendor will be responsible for and should include coordination with the District's Building Automation System provider (C & C Group) for proper integration and connection to the controls system. The selected vendor shall also provide a qualified electrician to make all disconnections, repair and replace conduit and wiring as necessary, and reconnect the new units.

Pre-Bid Meeting:

A pre-bid meeting will be held:

March 18, 2021 at 9:00 AM

Facilities Department
2220 N. 59th Street, Ste 229
Kansas City, KS 66104

A walk thru/site visit to all review of the project area will follow the Pre-Bid meeting. Attendance at the Pre-Bid Meeting is recommended, but not mandatory.

Unit Pricing:

All bidders will provide "Unit Pricing" cost information for:

1. EMT Conduit replacement per linear foot
2. Electric wire replacement per linear foot
3. Addition of convenience outlets (Note convenience outlets are not typically on every unit, but spaced such that field technicians can utilize 1 outlet for multiple units)

Basis of Design Notes:

1. York units are specified in the design documents as basis of design. The District will accept Trane or Aaon as alternates, with specific models to be reviewed and approved by the District's engineer per requirements of HVAC Specifications 1.11
2. The Vendor will verify locations of existing convenience outlets and coordinate replacement or addition with owner.

Bid Security

Bid Bond: Bid security shall be submitted with each bid in the amount of five percent (5%) of the bid amount. No bids may be withdrawn for a period of sixty (60) days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

Payment & Performance Bond: Bidder agrees to furnish a Payment & Performance Bond, in the amount of 100% (one hundred percent) of total contract value after receipt of contract.

Proposed Schedule:

Bidders will provide a proposed schedule of construction for each package.

Liquidated Damages

Completion of this project before August 1, 2021 is imperative. At the District's sole discretion, liquidated damages in the amount of Two-Hundred Dollars ($200.00) per calendar day will be assessed against the Contract if the project is not completed by the date indicated.

Clean-Up

The Contractor will keep the premises free from accumulations of debris and waste materials caused by its employees in performance of the work. At completion of the project, Contractor shall remove all crating, packaging, waste and debris from the building and the site, and all tools, scaffolding and surplus materials, and shall leave the building and site "broom clean" or its equivalent.

Permits, Codes and Ordinances

Each Contractor shall file and pay for required permits affecting its work (if applicable). Each contractor shall conform to applicable codes and ordinances, including OSHA requirements.

Damage to District Property

Contractor at its own expense shall promptly remedy and repair all damages or loss to any property caused in whole or part by its employees, subcontractor(s), supplier or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable.

No Smoking: The District adheres to the mandatory "No Smoking" policy on school premises and/or at school functions. All bidders shall comply with this "No Smoking" policy.

Multiple Low Bids: Although under the same bid number, each site will be awarded to the lowest responsible bidder an individual site basis.

In the event a contractor is the apparent low bidder for multiple sites, the contractor will be asked by the District if it has the capacity in resources and availability of schedule to handle such a multiple site award.

a) If answered in the affirmative, the recommendation of the multiple site award will be made to the Board of Education, and upon Board approval, the award will be made.
b) If, answered in the negative, that schedule and resources do not permit, then the apparent low bidder will be allowed to withdraw one or more its bids.
    - The bid(s) affected by the withdrawal will then move the next lowest responsible bidder. The same inquiry regarding capacity and schedule will be made of the next bidder…

- Once a contractor is determined under this scenario, the recommendation of award made to the Board of Education, and upon Board approval, the award will be made.

BID FORM

By signing this bid form, the vendor certifies the forms being offered meets or exceeds all requirements and conditions of the bid, special provisions, and specifications. In compliance with the above and subject to all the conditions hereof, the undersigned offers and agrees to furnish all items upon which prices are quoted, at the price set opposite each item.

The undersigned certifies that no Federal, State, County or Municipal tax is included in the above quoted prices and that none will be added. Public schools are TAX EXEMPT. Exemption certificates will be provided upon request.

Bid Form A – Bridges/Wyandot Academy	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	
b. Model of New RTU	
3. Total (1+2)	$
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet

Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Bid Form B – Douglas Elementary	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	
b. Model of New RTU	
3. Total (1+2)	$

Bid Form B – Douglas Elementary	
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet
Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Bid Form C – Grant Elementary	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	
b. Model of New RTU	
3. Total (1+2)	$
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet
Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Bid Form D – Lindbergh Elementary	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	

Bid Form D – Lindbergh Elementary	
b. Model of New RTU	
3. Total (1+2)	$
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet

Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Bid Form E – New Stanley Elementary	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	
b. Model of New RTU	
3. Total (1+2)	$
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet

Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Bid Form F – Morse Early Childhood Center	
1. Cost of Demolition (to include all labor, materials, and other costs to remove and dispose of existing RTU)	$
2. Cost of New RTU (to include all labor, materials, and other costs to install and connect to power)	$
a. Manufacturer of New RTU	
b. Model of New RTU	
3. Total (1+2)	$
Unit Costs	
4. EMT Conduit Replacement Cost per Linear Foot	$ per linear foot
5. Electric Wire Replacement Cost per Linear Foot	$ per linear foot
6. Addition of Convenience Outlets per Outlet	$ per outlet

Number of Days After Receipt of Order to Start Project	Days
Number of Days to Complete Project	Days

Diversity Designation(s)	
MBE/WBE/Other Certification Is your firm certified MBE/WBE or Other? (Circle One)>>	Yes / No
If Certified MBE/WBE/Other, Please Identify Certification (example: "***MBE***")>>	

WE HEREBY AGREE TO FURNISH THE ITEMS ON WHICH PRICES ARE QUOTED ABOVE IN ACCORDANCE WITH ALL TERMS AND CONDITIONS PREVIOUSLY LISTED AND ANY ATTACHED SPECIFICATIONS.

BY: _____ DATE _____

TITLE: _____ FIRM: _____

PHONE: _____ EMAIL: _____

ATTACHMENT A – USD 500 STANDARD TERMS AND CONDITIONS

1. SCOPE: The following terms and conditions shall prevail unless otherwise modified by U.S.D. 500 within this bid document. U.S.D. 500 reserves the right to reject any bid which takes exception to these terms and conditions.
2. DEFINITIONS AS USED HEREIN:
   a. The term "bid request" means a solicitation of a formal sealed bid.
   b. The term "bid" means the price offered by the bidder.
   c. The term "bidder" means the offeror or Contractor.
   d. The term "U.S.D. 500" means Unified School District No. 500.
   e. The term "Board of Education" or "BOE" means the governing body of Unified School District No.500
3. COMPLETING BID: Bids must be submitted ONLY on the form provided in this bid document. All information must be legible. Any and all corrections and /or erasures must be initialed. Each bid sheet must be signed by the authorized bidder and required information must be provided.
4. CONFIDENTIALITY OF BID INFORMATION: Each bid must be sealed and submitted in or under cover of the enclosed envelope to provide confidentiality of the bid information prior to the bid opening. Supporting documents and/or descriptive literature may be submitted with the bid or in a separate envelope marked "Literature for Bid (Number)." Do NOT indicate bid prices on literature. All bids and supporting bid documents become public information after the bid opening and are available for inspection by the general public in accordance with the Kansas Open Records Act.
5. ACCURACY OF BID: Each bid is publicly opened and is made part of the public record of U.S.D. 500. Therefore, it is necessary that any and all information presented is accurate and/or will be that by which the bidder will complete the contract. If there is a discrepancy between the unit price and extended total, the unit price will prevail.
6. SUBMISSION OF BID: Bids are to be sealed and submitted to the Purchasing Department Office, 2010 North 59th Street, Room 370, Kansas City, Kansas, 66104, prior to the date and time indicated on the cover sheet.
7. ADDENDA: All changes in connection with this bid will be issued by the Purchasing Office in the form of a written addendum. Signed acknowledgement of receipt of each addendum must be submitted with the bid.
8. LATE BIDS AND MODIFICATION OR WITHDRAWALS: Bids received after the deadline designated in this bid document shall not be considered and shall be returned unopened.
9. BIDS BINDING: All bids submitted shall be binding upon the bidder if accepted by U.S.D. 500 within sixty (60) calendar days after the bid opening.
10. EQUIVALENT BIDS: When brand or trade names are used in the bid invitation, it is for the purpose of item identification and to establish standards for quality, style and features. Bids on equivalent items of substantially the same quality, style and features are invited unless items are marked "No Substitute." Equivalent bids must be accompanied by descriptive literature and/ or samples may be required and shall be supplied at no charge to the school district.
11. NEW MATERIALS, SUPPLIES AND EQUIPMENT: Unless otherwise specified, all materials, supplies or equipment offered by a bidder shall be new, unused, of recent manufacture, first class in every respect, and suitable for their intended purpose. All equipment shall be assembled and fully serviced, ready for operation when delivered.
12. WARRANTY: Supplies or services furnished as a result of this bid shall be covered by the most favorable commercial warranties, expressed or implied, that the bidder and/or manufacturer gives to any customer. The rights and remedies provided herein are in addition to and do not limit any rights afforded to U.S.D. 500 by any other clause of this bid reserves the right to request from bidders a separate manufacturer certification of all statements made in the Proposal.
13. METHOD OF AWARD AND NOTIFICATION: Bids will be analyzed and the award made to the lowest and best, responsive and responsible bidder(s) whose bid conforms to the specifications and whose bid is considered to be the best value in the opinion of U.S.D. 500.
14. U.S.D. 500 reserves the right to reject any or all bids and any part of a bid: to waive informalities, technical defects, and minor irregularities in bids received: and to award the bid on an item by item basis by specified groups of items or to consider bids submitted on an "all or nothing "basis if the bid is clearly designed as such or when it is determined to be in the best interest of U.S.D. 500.
15. The signed bid shall be considered an offer on the part of the bidder: such offer shall be deemed accepted upon the issuance by U.S.D. 500 of a Purchase Order or other contractual document.
16. DELIVERY TERMS: All deliveries shall be F.O.B. Destination and all freight charges shall be included in the bid price.
17. DAMAGED AND/OR LATE SHIPMENTS: U.S.D 500 has no obligation to accept damaged shipments and reserves the right to return at the Contractor's expense damaged merchandise even though the damage was not apparent or discovered until after receipt of the items. The Contractor is responsible to notify U.S.D. 500 Purchasing Office of any late or delayed shipments. U.S.D. 500 reserves the right to cancel all or any part of an order if the shipment is not made as promised.
18. CREDIT TERMS: Bidder shall indicate all discounts for full and/or prompt payment. Discounts shall be considered as a cost factor in the determination of award, except discounts offered for payment within less than ten (10) calendar days. Discounts offered shall be computed from date of receipt of correct invoice or receipt and acceptance of products, whichever is later.

19. SELLER'S INVOICE: Invoices shall be prepared and submitted in duplicate to address shown on the Purchase Order. Invoices shall contain the following information: Purchase Order number, contract number, item number, description of supplies or services, sizes, unit of measure, quantity, unit price and extended totals.
20. TAX EXEMPT: U.S.D. 500 is exempt from Federal, State and local taxes by KS-FZLEKBLQ. Sites of all transactions under the order(s) that shall be derived from this bid request shall be deemed to have been accomplished within the State of Kansas.
21. SAFETY: All practices, materials, supplies and equipment shall comply with the federal Occupational Safety and Health Act, as well as any pertinent Federal, State and/or local safety or environmental codes.
22. DISCLAIMER OR LIABILITY: U.S.D. 500 will not hold harmless or indemnify any bidder for any liability whatsoever.
23. TERMINATION RIGHTS: KCKPS shall have the right to terminate/cancel the Agreement for its convenience and without penalty upon thirty (30) days prior written notice to the Contractor.
24. HOLD HARMLESS: The Contractor agrees to protect, defend, indemnify and hold the Board of Education, its officers, employees and agents fee and harmless from and against any and all losses, penalties, damages, settlements, costs, charges, professional fees or other expenses or liabilities or every kind and character arising out of or relating to any and all claims, liens, demands, obligations, actions, proceedings or causes of action of every kind and character in connection with or arising directly or indirectly out of this agreement and/or the performance hereof. Without limiting the generality of the foregoing, any and all such claims, etc., relating to personal injury, infringement of any patent trademark, copyright (or application for any thereof) or of any other tangible or intangible personal or property right, or actual or alleged violation of any applicable statute, ordinance, administrative order, rule or regulation, or decree of any court, shall be included in the indemnity hereunder. The Contractor further agrees to investigate, handle, respond to, provide defense for and defend any such claims, etc., at his/her sole expense and agrees to bear all other costs and expenses related thereto, even if such claim is groundless, false or fraudulent.
    NO MUTUAL INDEMNIFICATION:
    K.S.A.72-8201a: Contracts; indemnification or hold harmless provisions, void.
    (a) It is the public policy of the state of Kansas that all contracts entered into by the board of education of a school district, or any officers or employees thereof acting on behalf of the board, provide that the school district and board of education shall be responsible solely for the district's or board's actions or failure to act under a contract.
    (b) The board of education of a school district or any officers or employees thereof acting on behalf of the board shall not have the authority to enter into a contract under which the school district or board agrees to, or is required to, indemnify or hold harmless against damages, injury or death resulting from the actions or failure to act on the part of any party to a contract other than the board or district.
    (c) The provisions of any contract entered into in violation of this section shall be contrary to the public policy of the state of Kansas and shall be void and unenforceable.
25. INSURANCE: Upon receipt of award, Contractor shall provide Certificate of Insurance as required within three (3) days after notification issued by the Purchasing Department.
    A. The following general insurance requirements apply to any and all work under this contract by all Contractors and subcontractors of any tier.
    (1) Any and all insurance required by this contract with each and any and all insurance required by this contract shall be maintained during the entire length of this contract, including any extensions thereto, and until all work has been completed to the satisfaction of the Kansas City Kansas Public Schools. Any and all insurance must be on an occurrence basis.
    (2) No Contractor or subcontractor shall commence work under a contract until all insurance requirements contained within the solicitation have been complied with and until evidence of all insurance requirements in each and every contract with each and every subcontractor of any tier and shall require the same to comply with all such requirements.
    (3) The Kansas City Kansas Public Schools shall be covered as an Additional Insured under any and all insurance required by this contract. Confirmation of this shall appear on all certificates of insurance and on any and all applicable policies. The title of the awarded contract shall also appear on any and all applicable policies.
    (4) The Kansas City Kansas Public Schools shall be given no less than thirty (30) days' written notice of cancellation. The Kansas City Kansas Public Schools shall be given not less than thirty (30) days' prior written notice of material changes of any insurance required under this contract. The Kansas City Kansas Public Schools shall be given written notice of renewal of coverage not less than thirty (30) days prior to the expiration of any particular policy.
    (5) Each and every agent shall warrant when signing the certificate of insurance that he is acting as an authorized representative on behalf of the companies affording insurance coverage under the contract and that he is licensed by the State of Kansas to conduct insurance business in the State of Kansas and that the companies affording insurance coverage are currently licensed by the State of Kansas and are currently in good standing with the Commissioner of Insurance for the State of Kansas.
    (6) Any and all companies providing insurance required by this contract shall meet the minimum financial security requirements as set forth below. The rating for each company must be indicated on the certificate of insurance.
    For all contracts, regardless of risk, companies providing insurance under this contract must have a current:
        (a) Best's Rating not less than A, and
        (b) Best's Financial Size Category not less than Class VII

(7) In the event the Contractor neglects, refuses, or fails to provide insurance required by the contract documents, or if such insurance is canceled for any reason, Kansas City Kansas Public Schools shall have the right, but not the duty, to procure the same, and the cost thereof shall be deducted from monies then due or thereafter to become due to the Contractor or Kansas City Kansas Public Schools shall have the right to cancel the contract.

B. Worker's Compensation and Employer's Liability Insurance

The Contractor shall procure and maintain Worker's Compensation and Employer's Liability Insurance in the following limits. Such insurance is to cover each and every employee who is or may be engaged in work under this contract.

Worker's Compensation.....Statutory

Employer's Liability

Bodily Injury by Accident.....$1,000,000 each accident

Bodily Injury by Disease.....$1,000,000 each employee

Bodily Injury by Disease.....$1,000,000 policy limit

C. Comprehensive General Liability Insurance

The Contractor shall procure and maintain Comprehensive Insurance in an amount not less than $1,000,000 for bodily injury and property damage combined single limit. The following specific extensions of coverage shall be provided and indicated on the certificate of insurance:

(1) Comprehensive Form
(2) Contractual Insurance
(3) Personal Injury
(4) Broad Form Property Damage
(5) Premises – Operations
(6) Completed Operations

This coverage shall cover the use of all equipment, hoists, and vehicles on the site(s) not covered by Automobile Liability under this contract. Policy coverage must be on an occurrence basis.

D. Automobile Liability Insurance

The Contractor shall procure and maintain Automobile Liability Insurance in an amount not less than $1,000,000 for bodily injury and property damage combined single limit. The following extensions of coverage shall be provided and indicated on the certificate of insurance.

(1) Comprehensive Form
(2) Owned, Hired, Leased and non-owned vehicles

If the Contractor does not own any vehicles in the corporate name, non-owned vehicles coverage shall apply and must be endorsed on either the Contractor's personal automobile policy or the Comprehensive General Liability coverage required under this contract.

E. Commercial Crime insurance (when applicable)

The Contractor shall procure and maintain Commercial Crime/Fidelity insurance in an amount not less than $1,000,000.00, including coverage for theft or loss of KCKPS property.

26. LAW GOVERNING: All contractual agreements shall be subject to, governed by, and construed according to the laws of the State of Kansas.
27. ANTI-DISCRIMINATION CLAUSE: No bidder on this request shall in any way, directly or indirectly, discriminate against any person because of age, race, color handicap, sex, national origin, or religious creed.
28. BID BOND/PERFORMANCE BOND (Applicable to Construction/Remodel/Repair Projects, Unless Waived by the District)
    A. Each proposal must be accompanied by a certified or cashier's check, or a bid bond in the amount of five percent (5%) of the Contractor's total bid.
    B. A Performance Bond and a Material and Labor Payment Bond in amounts equal to one hundred percent (100%) of the contract price shall be furnished by the successful bidder. Bonds shall be issued by a surety acceptable to the Board.
29. DISQUALIFICATION:
    A. The Director of Purchasing may, at her/his sole discretion, disqualify a bidder for one or any combination of the following reasons:
        1. Bidder's product does not meet the specifications or bid conditions of the solicitation;
        2. Bidder's tendered bid is not received on the District's bid form;
        3. Bidder's tendered bid is not signed;
        4. Required bid bond is not furnished at time of bid opening;
        5. Failure to comply with bid instructions, terms and conditions that are judged to be essential to the competitive process and in the best interests of the District.
    B. Disqualification of bidders on future bids may be considered for any one or combination of the following reasons:
        1. Refusal of the bidder to complete a contract or bid;
        2. Bidder's past history of late deliveries or partial/incomplete shipments,
        3. Bidder's products or services have proven unreliable, unworkable or have not accomplished the result requested in the District's specifications.

30. SUPPLIER DIVERSITY: The Kansas City Kansas Public Schools encourages supplier diversity and participation of MBE/WBE/DBE designated businesses. However, such participation will not result in any selection or scoring advantage in the bid evaluation process.
31. **INCLEMENT WEATHER / EMERGENCY:**
    IF THERE IS A SCHOOL CLOSING THE DAY OF A SCHEDULED BID OPENING DUE TO INCLEMENT WEATHER OR AN EMERGENCY, THE BID OPENING WILL OCCUR AT 2:00 PM (CENTRAL) THE NEXT BUSINESS DAY THAT THE DISTRICT IS OPEN.

DIVISION 23
TABLE OF CONTENTS

SECTION 230010 – MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Mechanical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

A. This DIVISION requires the furnishing and installing of complete functioning Mechanical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.
B. Refer to Architectural, Structural and Electrical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing piping and ductwork in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

A. The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 13300 W 98th Street, Lenexa, KS 66215, PHONE 913-492-2400, EMAIL admin@pkmreng.com.
B. Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.
C. When a word, such as “proper”, “satisfactory”, “equivalent”, and “as directed”, is used, it requires the Architect-Engineer’s review.
D. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.
E. "INSTALL" means to join, unite, fasten, link, attach, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.
F. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.
G. "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.
H. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
I. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.
J. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.4. QUALIFICATIONS

A. The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

A. The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.6. CONTRACT CHANGES

A. Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

A. Locations of equipment, piping and other mechanical work are indicated diagrammatically by the mechanical drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other Contractors, and access requirements for installation and maintenance to approval of Architect-Engineer. Provide additional piping and ductwork offsets as required at no additional cost.
B. Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for figuring installation. Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.
C. Any pipe, ductwork, equipment, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.
D. Do not scale mechanical and electrical drawings for dimensions. Contractor shall accurately layout work from the dimensions indicted on the Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.
B. The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

A. The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
B. Warranty for all equipment shall take effect from the date of substantial completion regardless of the date equipment was installed.
C. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

A. Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

A. The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.
D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.
E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.
F. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they

shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

G. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

H. Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. TEMPORARY USE OF PERMANENT HVAC UNITS

A. If the Contractor elects to use permanent equipment for temporary conditioning only that permanent equipment associated with the heating system shall be allowed for use as space conditioning during the construction period. The Mechanical Contractor shall take full responsibility for all permanent equipment used for temporary conditioning during the construction period and shall provide a total of two years warranty covering all parts and labor on all permanent equipment utilized for temporary conditioning. This warranty shall cover all piping, fittings, valves, pipe and equipment insulation, pumps, boilers, chillers, condensing units, cooling towers, air handling units, exhaust and relief air fans, ductwork, ductwork insulation, diffusers, temperature controls, all electric motors, starters, disconnect switches, fuses, wire and conduit. This warranty shall cover all required maintenance on the system with the exception of filter changes, and shall start on the date shown on the final completion certificate.

B. CAUTION: The Contractor is being warned that the Architect-Engineer will not accept dirty equipment caused by construction contamination.

1.13. OPENINGS, ACCESS PANELS AND SLEEVES

A. This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed prevent entry and movement of rodents and insects. Contractor shall coordinate their work with all other trades.

1.14. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.15. EXTENT OF CONTRACT WORK

A. Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.

B. Electrical work required to install and control mechanical equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal. Mechanical systems and components are to be installed as a complete system, including all miscellaneous interlock (low voltage and minor line voltage power wiring such as control motors, limit switches, relays, etc), control wiring, safeties. Coordinate interlock to other systems such as fire alarm that interlock to mechanical systems and insure that provisions are made in equipment for connection of these systems. Coordinate with all other trades for specific needs and requirements based on submitted systems.

C. Contractor shall become familiar with equipment provided by other contractors that require mechanical connections and controls.

D. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.

E. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by Mechanical Contractor at no cost to Owner or Architect-Engineer.
F. Contractor shall be responsible for providing supervision to Electrical Contractor to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.
G. Furnish four complete sets of electrical wiring diagrams to Architect-Engineer to be included in the maintenance manuals and three complete sets to Electrical Contractor. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by Electrical Contractor shall be clearly indicated by notation and drawing symbols on wiring diagrams.
H. Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form that shall be presented monthly or on request, to Electrical Contractor. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow Electrical Contractor to order electrical equipment required in his contract.

1.16. WORK NOT INCLUDED IN CONTRACT

A. Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

1.17. CODES, RULES AND REGULATIONS

A. Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.
B. Conform to latest editions and supplements of following codes, standards or recommended practices.
C. BUILDING CODES:

1. International Codes (Latest adopted version of applicable codes)

D. SAFETY CODES:

1. National Electrical Safety Code Handbook H30 - National Bureau of Standards.
2. Occupational Safety and Health Standard (OSHA) - Department of Labor.

E. NATIONAL FIRE CODES:

1. NFPA No. 54 National Fuel Gas Code
2. NFPA No. 70 National Electrical Code
3. NFPA No. 89M Clearances, Heat Producing Appliances
4. NFPA No. 90A Air Conditioning and Ventilating Systems
5. NFPA No. 204 Standard for Smoke and Heat Venting

F. UNDERWRITERS LABORATORIES INC:

1. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

G. MISCELLANEOUS CODES:

1. ANSI A117.1 - Handicapped Accessibility
2. Americans with Disabilities Act (ADA)

H. ENERGY EFFICIENCY REQUIREMENTS:

1. All mechanical systems and components shall be manufactured and installed in compliance with ASHRAE 90.1 – 2007 and latest adopted version of IECC.

1.18. STANDARDS

A. Drawings and specifications indicate minimum construction standard. Should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect-Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

1.19. PERMITS/FEES

A. The Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect-Engineer with request for final inspection.

B. The Contractor shall include in their base bid any fees or charges by the local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exactly which part of the work required for the new utility service, is to be performed by the contractor and which part will be supplied by the utility company.

PART 2 - PRODUCTS

2.1. Not Used

PART 3 - EXECUTION

3.1. SUBMITTALS

A. Contractor shall furnish submittals of all materials and equipment required by the specifications. Refer to each specification section for the submittals (if any) required for that section.

B. Submittal format shall be as indicated below. Submittals not meeting these requirements will be returned without action for re-submittal.

1. Submittals shall be furnished in an Adobe PDF format.
2. Submittals shall be per individual submittal section, as listed in the table of contents. All required submittals within that section shall be grouped together in a single submittal.
    a. Furnishing submittals by division or by individual item may result in delayed reviewing of the submittal(s) due to additional administrative time required to process the large size and/or quantity of files.
3. Submittals shall have a cover page containing the following information: The project name, the applicable specification section and paragraph, the submittal date, and the Contractor's stamp (see below for requirements).
4. Mark each submitted item as applicable with scheduled mark, name, etc. corresponding to the plans.
5. Where generic catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Each catalog sheet shall bear the equipment manufacturer’s name and address.
6. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization.
7. All submittals on materials and equipment listed by UL shall indicate UL approval on submittal.

C. Contractor review:

1. Contractor shall check all submittals to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All submittals submitted to Architect-Engineer shall bear contractor’s approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor’s submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All submittals not meeting Contractor’s approval shall be returned to their supplier for re-submittal.
2. No submittals will be considered for review by the Architect-Engineer without Contractor’s approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor’s review.
3. Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

D. Review Schedule:

1. The shop drawing / submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus a duplication of this time for re-submittal if required.
2. Submittal of all shop drawings as soon as possible after permitting approval but before construction

starts is preferred.

3. Approval of shop drawings submitted prior to receipt of a permit for that respective scope of work should be considered conditional pending review/approval of the construction documents by the AHJ. Changes required to the submittal as a result of permitting comments received after architect's/engineer's review shall not be a justification for a change in price.
4. Any time delay caused by correcting and re-submitting submittals/shop drawings will be the Contractor's responsibility.

E. The Architect's-Engineer's checking and subsequent review of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.
F. Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.
G. Submittals that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.
H. Coordination

1. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc) that will interface with installation. Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.

3.2. SHOP DRAWINGS

A. Shop drawings shall meet all of the above requirements for submittals.
B. Contractor shall submit Adobe PDF sets of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.
C. No work shall be fabricated until Architect-Engineer's review has been obtained.
D. Sheet metal shop drawings for duct fabrication shall be a minimum of 1/4" scale. Sheet metal shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work. Duct layout indicating pressure classifications and sizes on plans, fittings, reinforcement and spacing, seam and joint construction, penetrations through fire-rated and other partitions, hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

A. Submit with shop drawings of equipment, four copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Equipment manufacturer shall prepare instructions.
B. Keep in safe place, keys and wrenches furnished with the equipment provided under this contract. Present to the Owner and obtain a receipt for them upon completion of project.
C. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined above.
2. Record copy of all submittals indicating actual equipment installed indicating options, characteristics. Copies of submittals shall bear the stamps of all parties that reviewed submittals.
3. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
4. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.

D. Provide brochures bound in three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

1. Project name and address.
2. Section of work covered by brochure, i.e., "Plumbing", etc.

3.4. RECORD DOCUMENTS

A. A. During construction, keep an accurate record of all deviations between the work as shown on Drawings and that which is actually installed. Keep this record set of prints at the job site for review by the Architect/Engineer.
B. Upon completion of the installation and acceptance by the owner, transfer all record drawing information to one neat and legible set of prints. Then deliver them to the Architect/Engineer for transmittal to the Owner.
C. Provide one copy of on high quality heavy weight presentation type paper. Blueprints or other media which fade shall not be used.
D. Provide one electronic scanned version of record documents in Adobe PDF format on a DVD. Transmit DVD in conjunction with hard copy documents.

3.5. CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
B. Contractor shall clean up all ductwork and equipment at the completion of the project.
C. All equipment, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

3.6. WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense

3.7. CUTTING AND PATCHING

A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Remove walls, ceilings and floors (or portions thereof) necessary to accomplish scope of work. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.
B. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.
C. Patching shall be by the contractors of the particular trade involved, shall match the existing construction type, quality, finish and texture, and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of mechanical work shall be repaired at Contractor's expense to approval of Architect-Engineer.

3.8. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instructions.
B. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
C. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
D. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.
E. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect-Engineer for review before proceeding with fabrication or installation.

3.9. START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

A. Contractor shall perform the initial start-up of the systems and equipment and shall provide necessary supervision and labor to make the first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturer's technicians, and the Owner's operating personnel shall be

present during these operations.

B. Contractor shall be responsible for training Owner's operating personnel to operate and maintain the systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructors name, names of Owner's personnel attending and total hours of instruction given each individual.

C. All owner-training sessions shall be orderly and well organized and shall be video recorded digitally. At the end of the owner training, the "training" session recording shall be transmitted to the owner via DVD and shall become property of the owner.

3.10. FINAL CONSTRUCTION REVIEW

A. At final construction review, each respective Contractor and major subcontractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by the Architect-Engineer, that the work complies with the purpose and intent of the contract documents. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

END OF SECTION 230010

SECTION 230011 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Provide documentation of all completed tests described herein and their results.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1. TESTING PROCEDURES FOR PIPING SYSTEMS

A. Test all lines and systems before they are insulated, painted or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor and equipment required for tests.
B. Where entire system cannot be tested before concealment, test system in sections. Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests. Upon completion, each system shall be tested as an entire system.
C. Repair or replace defects, leaks and material failures revealed by tests and then retest until satisfactory. Make repairs with new materials.
D. All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.
E. Upon completion of testing submit five copies of a typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time and all failures with corrective action taken.
F. For test pressure schedules see piping material schedules.

3.2. TEST METHODS AND PRESSURES

A. Test methods and pressures shall be as follows:

1. Hydrostatic Test (Open System):

a. Test entire system with 10-foot head of water. Where system is tested in sections each joint in building except uppermost 10 feet of system shall be submitted to at least 10-foot head of water. Water shall be held in system for 15 minutes before inspection starts. System shall hold test pressure without leaks.

2. Pneumatic Test:

a. Test entire system with compressed air. Systems operating above 25 PSI shall be tested at 75 PSI or 15% of operating pressure or whichever is greater.
b. Allow at least 1 hour after test pressure has been applied before making initial test.
c. Curing test, completely isolate entire system from compressor or other sources of air pressure.

3.3. MISCELLANEOUS CONTROL WIRING

A. All control wiring regardless of voltage shall be routed in a concealed manner.
B. All exterior control wiring shall be installed in conduit.
C. Wiring to thermostats and other wall mounted devices and sensors shall be routed in ¾" conduit to backboxes in walls and to an accessible ceiling or location.
D. All conduit and wiring shall be installed in accordance with Division 26.
E. Cabling and circuiting shall be plenum rated where required.
F. Refer to additional specifications where systems and controls are specified as DDC or similar.

3.4. CLEANING OF SYSTEMS AND EQUIPMENT

A. After pressure testing of systems and equipment and before operational test thoroughly clean interiors of piping and equipment. Clean equipment as recommended by equipment manufacturers. Where specific instructions are not provided clean equipment systems as follows:

1. Air Handling Systems:

a. Before starting any air system clean all debris, foreign matter and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blower, etc., with throw-away filters. After cleaning air system install temporary filters and run continuously for a minimum of eight hours at full volume before installing permanent filters. Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment by mechanical contractor before final acceptance inspection by Architect and Engineer.

3.5. MAINTENANCE OF SYSTEMS

A. Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.
B. Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.
C. Records shall indicate types of lubricants used and date or time when next maintenance or lubrication will need to be performed by Owner. Where special lubricants are required, Contractor shall provide Owner with a one year supply as determine by Equipment Manufacturer's recommendations.

3.6. PAINTING OF MATERIALS AND EQUIPMENT

A. Touch-up painting and refinishing of factory applied finishes shall be by Mechanical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.
B. Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.
C. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
D. Where extensive refinishing is required equipment shall be completely repainted.

3.7. FIRE BARRIERS

A. General

1. For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Submittals

1. Product Data: For Each Type Of Product Indicated.
2. Shop Drawings: For Each Through-Penetration Firestop System, Show Each Type Of Construction Condition Penetrated, Relationships To Adjoining Construction, And Type Of Penetrating Item. Include Firestop Design Designation Of Qualified Testing And Inspecting Agency That Evidences Compliance With Requirements For Each Condition Indicated.

a. Submit Documentation, Including Illustrations, From A Qualified Testing And Inspecting Agency That Is Applicable To Each Through-Penetration Firestop System Configuration For Construction And Penetrating Items.
b. Where Project Conditions Require Modification To A Qualified Testing And Inspecting Agency's Illustration For A Particular Through-Penetration Firestop Condition, Submit Illustration, With Modifications Marked, Approved By Through-Penetration Firestop System Manufacturer's Fire-Protection Engineer As An Engineering Judgment Or Equivalent Fire-Resistance-Rated Assembly.

3. Through-Penetration Firestop System Schedule: Indicate Locations Of Each Through-Penetration Firestop System, Along With The Following Information:

a. Types Of Penetrating Items.
b. Types Of Constructions Penetrated, Including Fire-Resistance Ratings And, Where Applicable, Thicknesses Of Construction Penetrated.
c. Through-Penetration Firestop Systems For Each Location Identified By Firestop Design Designation Of Qualified Testing And Inspecting Agency.

C. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

D. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
E. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
F. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.
G. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.
H. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
I. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.
J. Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson “Flameseal” fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.
K. Equivalent by Hilti, Inc., Johns Manville, Nelson Firestop Products, NUCO Inc., RectorSeal Corporation, Specified Technologies Inc., 3M, Tremco, USG, Dow, Chemelex.

END OF SECTION 230011

SECTION 230013 – PROJECT COORDINATION

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).

B. Each related sub-contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3. COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Delivery and processing of submittals.
2. Progress meetings.
3. Preinstallation conferences.
4. Project closeout activities.
5. Startup and adjustment of systems.

1.4. SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Format shall be PDF or other electronic format to facilitate multiple user commenting and sharing easily.
3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including project managers, superintendent and other personnel in attendance at Project site to the General Contractor and other major subcontractors. Identify individuals and their duties and responsibilities; list email addresses and telephone numbers. Update the list as required during the project if personnel change.

1.5. COORDINATION

A. Certain materials will be provided by other trades. Examine the Contract Documents and reviewed record Submittals to ascertain these general requirements. Contract Documents reflect a basis of design and may not reflect actual equipment or items being utilized.
B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.
C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.
D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
E. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the Architect/Engineer. Do not proceed with work that is incompatible with equipment provided.
F. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
G. Coordinate with the local Utility Companies to their requirements for service connections and provide all necessary materials, labor and testing.
H. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.
I. Conduct a coordination meeting after reviewing all other trade coordination drawings with other relevant trades. This meeting shall be held to prevent conflicts during construction. Each major relevant subcontractor shall attend this meeting. Report any potential conflicts or clearance problems to Architect/Engineer after meeting.
J. Adjust location of piping, ductwork, conduit, wiring, etc. to prevent interferences, both anticipated and encountered. Determine the exact route and location of each item prior to fabrication.

1. Right-of-Way:

a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

1.6. DRAWINGS AND FILES.

A. The Drawings show only the general run of MEP systems, equipment, fixtures, piping and ductwork and other components as well as approximate location of items such as outlets, switches, diffusers, lights, and equipment connections, etc. Coordinate all exact locations of items with other trades, architectural elevations, equipment requirements, owner requirements, ceilings, access, serviceability, etc. All such modifications and coordination shall be made without additional cost to the Owner. Any significant changes in location of items necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made
B. Wherever the work is of sufficient complexity, additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the

area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field. Attend meetings with other trades to review all documents.

C. When directed by the General Contractor for areas of necessary coordination provide 3D building modelling coordination files and documents with other trades. Transmit information electronically and attend meetings as directed by the G/C as well as take part in coordination activities and documentation. Contractor shall be required to generate their own electronic files for this process.

1.7. PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. The Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Manufacturer's written recommendations.
    l. Warranty requirements.
    m. Compatibility of materials.
    n. Space and access limitations.
    o. Regulations of authorities having jurisdiction.
    p. Testing and inspecting requirements.
    q. Installation procedures.
    r. Coordination with other work.
    s. Required performance results.
    t. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other

items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to Construction Schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.

b. Review present and future needs of each contractor present, including the following:

i. Interface requirements.
ii. Sequence of operations.
iii. Status of submittals.
iv. Deliveries.
v. Off-site fabrication.
vi. Access.
vii. Quality and work standards.
viii. Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8. REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI.

1. Submit Contractor's suggested solution(s) to RFI. If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
2. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 220013

SECTION 230505 – MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 220500.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of the following:

1. Mechanical and electrical equipment, devices, piping, conduits, ductwork, insulation, lighting, etc in existing building indicated on drawings and as required to accommodate new construction.
2. Removal of MEP items in interior partitions as indicated on drawings.
3. Removal and protection of existing fixtures, materials, and equipment items indicated to be removed, salvaged, relocated, reinstalled, etc.

1.3. SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Schedule indicating proposed sequence of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed remodeled areas.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Architect prior to start of work.

1.4. JOB CONDITIONS

A. Occupancy:

1. Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in such a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.

B. Condition of Structures:

1. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of Contractor's inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
2. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.
3. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
4. Provide protective measures as necessary and required to provide free and safe passage of Owner's personnel and general public to any occupied portions of building.
5. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
6. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
7. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
8. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

9. Remove protections at completion of work.

C. Damages:

1. Promptly repair damages caused to adjacent facilities by demolition work.

D. Traffic:

1. Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

E. Flame Cutting:

1. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

G. Maintain fire protection services during selective demolition operations.

H. Environmental Controls:

1. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing and/or approved regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1. PREPARATION

A. General:

1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
2. Cease operations and notify Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

B. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to any occupied portions of the building.

C. Where selective demolition occurs immediately adjacent to any occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation as required by Architect.

1. Provide weatherproof closures for exterior openings resulting from demolition work.

D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to any occupied areas of building. Provide minimum of 72 hours advance notice to Architect if shutdown of service is necessary during changeover.

3.2. DEMOLITION

A. General:

1. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive

loads on supporting walls, floors, or framing.

D. Provide services for effective air and water pollution controls as required.

E. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

F. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to architect in written accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3. SALVAGED MATERIALS

A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain a receipt.

3.4. DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on Project site.

3.5. CLEANUP AND REPAIR

A. General:

1. Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 230505

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.1. MOTORS

A. Motors shall be installed in strict accordance with rules set forth by NEC and equipment manufacturer.
B. ELECTRIC MOTORS (Less than ½ HP)

1. Motors 1/3 horsepower and smaller shall be selected by manufacturer of driven equipment with motor speed and torque characteristics best suited for application.
2. Motors shall have a minimum service factor of 1.15 for open dripproof enclosure and 1.00 for totally enclosed motors. Wherever applicable provide motors with cushion bases. Motor enclosure shall be proper type required for operating environment.
3. Motors shall have a plus or minus 10% voltage tolerance and plus or minus 5% frequency tolerance. Motors shall operate satisfactorily in ambient temperature range of 0 degrees C (32°F) to 140°C (104°F) at altitudes below 3300 feet.
4. Provide motors with built-in thermal overload protection. Motors readily accessible to operating personnel shall have manual reset protector. All other shall have automatic reset protectors.
5. Motors shall have AFBMA standard double-shielded ball bearings sized for average life of at least 100,000 hours under normal loading conditions. Bearings housing shall have provisions for adding new lubricant without major disassembly and shall have seals to prevent entrance of foreign matter and leakage of bearing lubricant.
6. Motor bolts, screws and other external hardware shall be treated with corrosion resistant plating and motor enclosure prime painted with corrosion resistant metal primer finished with a durable machinery enamel.
7. Unless indicated otherwise motors shall be rated for continuous operation at 115, 200, or 277 volt single phase 60 hertz. Where equipment manufacturer offers a choice provide permanent split capacitor motors in lieu of shaded pole motors.
8. Motor leads shall be marked throughout entire length for easy identification and terminate with brass or copper terminal lugs. Motor shall have permanently attached nameplate with electrical characteristics and wiring connection diagram.

C. ELECTRIC MOTORS (1/2 HP and Larger)

1. Provide equipment requiring electric motors with NEMA Standard motors. Shop drawings, submitted and equipment provided with electric motors shall include motor manufacturer, horsepower, voltage, full load amperes, NEMA design type, insulation class, shaft bearing type, mounting base type, and enclosure type. To greatest extent possible motors for this project shall be by one manufacturer.
2. Motors shall conform to current NEMA Standard MG1. Motor shall operate successfully without derating under the following conditions.
3. 40 degrees C (104°F) maximum ambient temperature, 3,300 Ft. maximum altitude, voltage variations of plus or minus 10% of nameplate rating, frequency variations of plus or minus 5% of nameplate rating, combined voltage and frequency variation of plus or minus 10% total as long as frequency does not exceed plus or minus 5%.
4. Motors shall meet or exceed locked rotor (Starting) and breakdown (maximum) torques specified for the NEMA design rating. Lock rotor currents shall not exceed NEMA maximum values for motor NEMA design rating.
5. Motor service factors shall be 1.15 for open dripproof motors and 1.00 for totally enclosed motors.
6. Unless indicated otherwise, motor insulation may be manufacturers standard for Class A, B or F provided that maximum permissible temperature for insulation is not exceeded when motor is operating at its service factor load in a 40 Degrees C (104°F) ambient.
7. Motor frame/HP relationship shall conform to current NEMA Standard for “T” frames. Motors shall have antifriction ball or roller bearings sized for average life of at least 100,000 hours under normal v-belt loading conditions. Bearings shall be AFBMA Standard and shield mounted ball bearings of ample capacity for motor rating. Bearing housing shall have provisions for adding new lubricant and

draining out old lubricant without major motor disassembly. Bearing housing shall have seals to protect bearing from entrance of foreign matter and to prevent leakage of bearing lubricant.

8. Conduit box mounting shall rotate to allow conduit entrance from top, bottom or either side. Conduit holes shall conform to NEC Standards.
9. Motor leads shall have same insulation class as motor windings. Leads shall be marked throughout entire length for easy identification and terminated with brass or copper terminal lugs. Motor shall have permanently attached nameplate with electrical characteristics and wiring connection diagram.
10. Motor bolts, screws and other external hardware shall be treated with a corrosion resistant plating. Motor enclosure shall be prime painted with corrosion resisting metal primer and finished with a durable machinery enamel paint.
11. Unless indicted otherwise motors shall be rated for continuous operation at rated voltage, three phase, 60 hertz. Motors shall be T-frame squirrel cage induction. Type NEMA design B with Class B insulation. Motors shall be dripproof totally enclosed or explosion-proof as required by motor environment.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 220513

SECTION 230514 – MOTOR CONTROL AND EQUIPMENT DISCONNECTS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 220010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of disconnect to be furnished.
B. Dimensional Drawings: For each respective type and size of disconnect.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Equivalents by: G.E., Cutler Hammer, or I.T.E. Siemens, Square D.

2.2. DISCONNECT SWITCHES

A. Provide heavy-duty horsepower rated Safety Switches rated in accordance with NEMA enclosed Switch Standard KS 1-1969 and L98 Standard.
B. Enclosure shall be NEMA type and material required by switch location and environment. Enclosure door shall latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity and application information.
C. Line terminals shall be permanently marked and shielded. Contact shall be tin plated, equipped with arch chutes and have movable contacts visible in off position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break spring driven anti-tease mechanism and shall be integral part of box. All current carrying parts shall be plated.
D. Fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the label may be easily read from the front and without removing the fuse.

PART 3 EXECUTION

3.1. INSTALLATION

A. All fuse holders shall have rejection clips installed.
B. Mount starter enclosure rigidly and with proper alignment on building structure or steel supports with operating switches not more than 6 feet above finished floor unless otherwise required. Use steel supports fabricated from standard rolled structural steel shapes or framing channel to provide one-inch separation between enclosure and building wall for vertical flow of air.
C. Furnish and install a nameplate for each starter/switch engraved with the equipment designation which the disconnect serves.
D. All starters/disconnect switches as specified shall be installed in strict accordance with rules set forth by NEC.
E. Install starters in locations as shown on plans, installation shall be in strict accordance with NEC, and manufacturer's installation requirements.

END OF SECTION 230514

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. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware. Black letters on white background.
B. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
C. 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.
D. Fasteners: Stainless-steel rivets or self-tapping screws.
E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
F. 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.
G. Install or permanently fasten labels on each major item of mechanical equipment.
H. Locate equipment labels where accessible and visible.

END OF SECTION 230553

SECTION 230593 – SYSTEM TESTING & BALANCING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. TESTING AND BALANCING CONTRACTORS

A. Testing and balancing (TAB) of the building air and hydronic systems will be to be completed near the end of construction. The Mechanical Contractor has responsibility to cooperate with, make adjustments for, and provide any equipment necessary for the TAB contractor to complete the job.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.1. SCOPE OF WORK

A. The Contractor shall procure the services of an independent air balance and testing contractor, approved by the A/E, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution and exhaust systems and all water flow circuits. All work by this contractor shall be done under engineer employed by them. All instruments used by this contractor shall be accurately calibrated and maintained in good working order. If requested the tests shall be conducted in the presence of the A/E responsible for the project and/or his representative. The testing and balancing contractor shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.
B. The balancing contractor shall prepare a certified report of all tests performed. The report shall be written on standard forms prepared by NEBB or AABC or facsimiles thereof. The balancing contractor shall submit 3 copies of this report to the Mechanical Contractor who shall submit them to the A/E for review and distribution.
C. Air balance and testing shall not begin until systems have been completed and are in full working order. All heating, ventilation, and air conditioning systems and equipment shall be in full operation during each working day of testing and balancing.

3.2. SYSTEM PREPARATION FOR TESTING AND BALANCING

A. Prior to requesting testing and balancing contractor to perform their work the installing contractor shall make all necessary inspections and adjustments to insure that systems are completely installed and operating in accordance with the manufacturer's recommendations and the contract documents.
B. The following checks shall be performed on each system installed under this contract. A report sheet shall be prepared for each system indicating checks made, corrective action taken where required, date, and name of person making inspection. Submit one copy to testing and balancing contractor and two to A/E. Testing and balancing contractor will not begin until checklist has been received and reviewed.

3.3. TEMPERATURE CONTROLS CONTRACTOR COORDINATION

A. The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.
B. For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

3.4. AIR HANDLING SYSTEMS:

A. Clear system of all foreign objects and clean system.
B. Verify fan rotation.
C. Check bearing condition and lubrication.
D. Check fan wheel clearances and fan alignment.
E. Check motor security to mounting base.

F. Check alignment of drive.
G. Check vibration isolator adjustment.
H. Verify that proper filter media is installed.
I. Verify that all control dampers are installed and operable without binding or sticking.
J. Confirm that all fire, smoke and volume dampers are installed and in full open position.
K. Verify that all air terminal units are installed.
L. Confirm that all air openings in walls above ceilings have been provided.
M. Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils.
N. Air leaks shall not exceed SMACNA parameters for system pressure.
O. Verify that ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.
P. Inspect and clean all coils (including evaporator and condenser) and correct fin damage.

3.5. AIR SIDE TESTING AND BALANCING

A. GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

1. 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.
2. Prepare schematic diagrams of systems' "as-built" duct layouts.
3. For variable-air-volume systems, develop a plan to simulate diversity.
4. The TAB contractor shall cycle each air handling unit through its control sequence of operation to verify proper operation. Any inconsistency with contract documents shall be reported to A/E and temperature control contractor. Temperature control contractor shall take prompt action to correct any control inconsistency as reported by the TAB contractor.
5. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
6. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
7. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
8. Verify that motor starters are equipped with properly sized thermal protection.
9. Check dampers for proper position to achieve desired airflow path.
10. Check for airflow blockages.
11. Check condensate drains for proper connections and functioning.
12. Check for proper sealing of air-handling-unit components.
13. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

B. PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

1. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
    a. Measure total airflow.
        i. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
    b. Measure fan static pressures as follows to determine actual static pressure:
        i. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
        ii. Measure static pressure directly at the fan outlet or through the flexible connection.
        iii. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
        iv. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
    c. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
        i. Report the cleanliness status of filters and the time static pressures are measured.
    d. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

e. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

f. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

g. 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 mode to determine the maximum required brake horsepower.

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

a. Measure airflow of submain and branch ducts.

i. 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.

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

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

3. Measure air outlets and inlets without making adjustments.

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

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

a. 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.

b. Adjust patterns of adjustable outlets for proper distribution without drafts.

C. PROCEDURES FOR HEAT-TRANSFER COILS

1. Measure, adjust, and record the following data for each electric heating coil:

a. Nameplate data.
b. Airflow.
c. Entering- and leaving-air temperature at full load.
d. Voltage and amperage input of each phase at full load and at each incremental stage.
e. Calculated kilowatt at full load.
f. Fuse or circuit-breaker rating for overload protection.

2. Measure, adjust, and record the following data for each refrigerant coil:

a. Dry-bulb temperature of entering and leaving air.
b. Wet-bulb temperature of entering and leaving air.
c. Airflow.
d. Air pressure drop.
e. Refrigerant suction pressure and temperature.

3.6. PROCEDURES FOR MOTORS

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

1. Manufacturer's name, model number, and serial number.
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 of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7. TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10% percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8. 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: Prepare biweekly progress 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.

3.9. FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. 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; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
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 supervisor 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's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, 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.

D. 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 outdoor, 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.

3.10. ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB 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 TAB during near-peak summer and winter conditions.

3.11. AIR AND WATER BALANCE CONSTRUCTION COORDINATION

A. During installation of the mechanical systems the testing and balancing contractor shall make no less than (3) inspection visits to the project site. Proper placement and installation of all control and balancing devices shall be verified by these inspections. The mechanical contractor shall make all corrections in control and balancing device locations as requested by the TAB contractor. Following each inspection visit the TAB contractor shall report to the A/E all items noted, action taken, and progress of control device installation. The last inspection and balancing shall be performed in the presence of a professional engineer active in the design of mechanical building systems.

END OF SECTION 230593

SECTION 230713 – DUCT INSULATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied jackets.
8. Tapes.

1.3. SUBMITTALS

1. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
2. 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.

B. QUALITY ASSURANCE

1. 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.

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

1.4. 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.

1.5. COORDINATION

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

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

2.2. DUCT LINER

A. Fibrous-Glass Duct Liner (Flat Applications): 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, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

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.

2.3. 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.

1. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I. 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).

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
C. 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.
D. PVC Jacket Adhesive: Compatible with PVC jacket.

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 dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3. INSULATION SCHEDULE

A. Refer to drawings for insulation and ductwork schedule.

3.4. GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment 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 and duct 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. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. 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.
4. For below ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. 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.
O. 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. Access doors.

P. Undamaged insulation systems on cold surface ductwork and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.
Q. 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. For double wall ductwork, secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. 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.

3.5. FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Tests and Inspections:

1. 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 for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. 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, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.
E. Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

3.6. FIELD QUALITY ASSURANCE

A. Upon completion of insulation work and before operation is to commence, visually inspect the work and verify that it has been correctly installed.
B. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.
C. Check the duct system to ensure that there are no air leaks through joints.

3.7. PROTECTION

A. Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with duct liner damage and moisture-saturated insulation.
B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

END OF SECTION 230713

SECTION 230923 – AUTOMATIC TEMPERATURE CONTROLS

PART 1 GENERAL

1.1. SUBMITTALS

A. Product Data: For each control device indicated.
B. Software and firmware operational documentation.
C. Field quality-control test reports.
D. Operation and maintenance data.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2. CONTROL SYSTEM

A. Manufacturers:

1. Schneider Electric (Formerly Invensys Building Systems)

B. Control system and components shall be backward compatible and utilize and support open protocols. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system and components shall be backward compatible and utilize and support open protocols. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3. UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

2.4. ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
B. Accuracy: Plus or minus 0.5 deg F at calibration point.
C. Wire: Twisted, shielded-pair cable.
D. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
E. RTDs and Transmitters:

1. Accuracy: Plus or minus 0.2 percent at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
4. Averaging Elements in Ducts: use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

PART 3 EXECUTION

3.1. ELECTRICAL POWER WIRING PROVISIONS

A. Provide a 20A/1P 120 or 277 volt circuit from the nearest panelboard related to the work for miscellaneous HVAC control system power. Contractor may provide multiple circuits at their option. Utilize spare circuit breakers or provide new when one is not available.
B. Coordinate with mechanical equipment specifics and contractors proposed method of control power provisions. All work shall comply with Division 26 requirements and latest adopted version of the National Electric Code.
C. Provide all necessary line voltage wiring and connections for control equipment, power supplies, dampers, actuators, and other items requiring line voltage power. This work shall be coordinated with other trades and shall be in conformance with other portions of this contract and requirements.

3.2. ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Install exposed cable in raceway, including mechanical rooms, at wall mounted control cabinets and any location control wiring would be exposed to view or damage. Exposed raceway in finished spaces shall be wiremold or similar appearing material and painted if required by the finish of the room.
2. Install concealed cable in walls and other non-accessible spaces in raceway. Wall mounted devices shall be provided with backbox and conduit.
3. Install cable in accessible plenums as plenum rated and properly supported.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

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.

3.3. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

3.4. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

4. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.
5. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5. DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230923

SECTION 232000 – HVAC PIPING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of product to be used.

PART 2 - PRODUCTS

2.1. PIPING MATERIALS

A. Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturers name and weight. See piping material schedule on the drawings for materials to be used for each piping system.

1. Polyvinyl Chloride Drain Waste Pipe:

a. Provide Schedule 40 polyvinyl chloride solid core plastic drain waste and vent pipe conforming to ASTM D2665. Joints shall be properly cleaned, primed and glued where scheduled.
b. Polyvinyl Chloride (PVC) Pipe & Fittings Cell Class 12454 B.

i. ASTM D 2241 SDR-26

c. Pipe by Charlot, Genova, Crestline or equal.

2.2. PIPING FITTINGS

A. Piping fitting used throughout project shall be proper type for installation method used and shall be compatible with piping system material. Fittings listed in piping material schedule shall conform to the following specifications:

1. PVC Fittings:

i. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.
ii. Joints shall be of a push-on type with a bell-end grooved to receive a synthetic rubber gasket when scheduled. Solvent welded joints are not allowed outside the building. The joint shall be made in accordance with ASTM D 3212.

b. Equivalents: Spears, Lasco or equal.

PART 3 - EXECUTION

3.1. PIPING INSTALLATION

A. Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc., as recommended by manufacturer and as specified and detailed on drawings.
B. Install piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping system. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves and fittings used are not exceeded during normal operation or testing of piping system.
C. Make changes in piping size and direction with approved factory made fittings. Provide fittings suitable for at least 125 PSI working pressure or of pressure rating required for maximum working pressure of system whichever is greater.

3.2. PIPING SUPPORTS, ANCHORS, SLEEVES AND SEALS

A. Furnish proper type and size pipe sleeves to General Contractor for installation in concrete or masonry walls or floors. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab or grade except where penetrating a membrane

waterproof floor.

B. Mechanical Contractor shall supervise installation of sleeves to insure proper location and installation.

C. Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved.

D. Sleeves passing through above grade floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchens shall be cast iron with integral flanges and shall extend 1 inch above finished floor. Size sleeves for and seal space between pipe sleeve with Thunderline Link-Seal.

3.3. PIPE HANGERS AND SUPPORTS

A. Equivalent hangers and supports by Auto-Grip, Basic Engineer, Bee Line, Elcen, Fee & Mason, Fluorocarbon Company, Unistrut or Super Strut Inc.

A. Provide premanufactured pipe support for piping located on flat roofs, unless otherwise indicated on drawings. Support will be of modular designs with roller bearings and guide saddles for straight piping runs longer than 50’ and Unistrut type clamp/support type for other shorter runs. Maximum pipe support spacing shall be 10’ for steel piping. Copper piping and refrigerant piping shall be supported at shorter distances. Piping near equipment connections shall be supported within 3’ of units. System supports shall be compatible with roofing materials and shall be provided with plates, pads, etc to spread weight and wear on roof surface. Provide pipe supports from Miro Industries, B-Line, or approved equivalent.

END OF SECTION 232000

SECTION 232016 – HVAC PIPING SPECIALTIES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.1. GAS PRESSURE REGULATORS

A. Provide gas pressure regulators with internal relief and low pressure cut-off as manufactured by Fisher Controls or Equimeter. Units shall be of size capable of capacities and pressures as shown on plans. Verify capacities and pressures with each piece of equipment served.

END OF SECTION 232016

SECTION 233113 – METAL DUCTS

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

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 shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4. SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

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 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.

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.
F. Field quality-control reports.

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. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct allowing for insulation if lined.

2.2. 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: G90.
    2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.3. 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. Sealant: Modified styrene acrylic.
    3. Indoor and outdoor, Water resistant, Mold and mildew resistant.
    4. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
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. Indoor or outdoor, Water resistant, Mold and mildew resistant.
    5. VOC: Maximum 75 g/L (less water).
    6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
D. Solvent-Based Joint and Seam Sealant:
    1. Application Method: Brush on.
    2. Base: Synthetic rubber resin.
    3. Solids Content: Minimum 60 percent.
    4. Indoor or outdoor, Water resistant, Mold and mildew resistant.
    5. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
E. Flanged Joint Sealant: Comply with ASTM C 920.
    1. General: Single-component, acid-curing, silicone, elastomeric.
F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
G. Pressure sensitive duct joint sealer:

1. Provide Hard Cast, Inc. “Foil Grip” pressure sensitive duct joint sealer. Seal class “A”, “B”, and “C”.

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. All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1” or 2” in height and width of ductwork as required to accommodate insulation thickness. Mount specialties such as turning vanes, dampers, etc., to ductwork with that section insulated “Build Outs” to maintain continuity of thermal barrier.

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. 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 scheduled seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
C. In residential occupancies duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer’s air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area.
3. Exception: The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope.

3.4. 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.

3.5. CONNECTIONS

A. Coordinate duct installations and specialty arrangements with Drawings.
B. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
C. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6. FIELD QUALITY CONTROL

A. Perform tests and inspections.

3.7. START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8. DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

SYSTEM	Material	Pressure Class	Min. SMACNA Seal Class	Leakage Class
Supply				
Ducts Connected to Constant-Volume Air-Handling Units	Galv. SM	2” Pos.	B	Round-3 Rect-6
Return				
Ducts Connected to Rooftop Air Conditioner Units	Galv. SM	2” Neg.	C	Round-3 Rect-6

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of product indicated.
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 and smoke-damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

2. Operation and maintenance data.

C. QUALITY ASSURANCE

1. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
2. Comply with AMCA 500-D testing for damper rating.

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: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. 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. 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.

1. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene. 26 oz./sq. yd. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

2.3. 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 and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Install test holes at fan inlets and outlets and elsewhere as indicated.
E. Install flexible connectors to connect ducts to equipment.
F. Connect terminal units to supply ducts directly with maximum 12-inch lengths of high pressure flexible duct. Do not use flexible ducts to change directions.
G. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
H. Connect flexible ducts to metal ducts with draw bands.
I. Install duct test holes where required for testing and balancing purposes.

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 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.

END OF SECTION 233300

SECTION 237416 – ROOFTOP HEATING/COOLING UNITS (3-20 TON)

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and scheduled.
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.
C. Field quality-control test reports.
D. Operation and maintenance data.

PART 2 PRODUCTS

2.1. GENERAL

A. Provide where shown on plans, rooftop units as hereinafter specified and indicated in the schedule.
B. Equivalents by York, Train, Aaon.

2.2. UNIT

A. Provide dedicated downflow or horizontal gas heating electric cooling rooftop air handling units capable of operating range between 115 deg F and 0 deg F cooling as shown on plans. Cooling performance shall be rated in accordance with DOE and /or ARI testing procedures. Unit shall be factory assembled, internally wired, fully charged with R-410a and 100 percent run-tested before leaving the factory. Wiring internal to the unit shall be colored and numbered. Unit shall be UL listed and labeled, classified in accordance to ANSI Z21.47 for gas-fired central furnaces and UL 1995/CAN/CSA No. 236-M90 for central cooling air conditioners.
B. Unit casing shall be constructed of zinc coated, min. 18 ga., galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall be hinged with tooless cam latch handles and be removable while providing a water and airtight seal. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1-1/8" high supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting. The top cover shall be one piece or where seams exist, it shall be double hemmed and gasket sealed.
C. Unit shall have scroll compressor(s). Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Internal spring isolation and sound muffling shall be provided. External high pressure cutout shall be provided. Low pressure switches shall be standard.
D. Each refrigerant circuit shall have independent fixed orifice expansion devices, service pressure ports and refrigerant line filter driers. An area shall be provided for replacement suction line driers.
E. Provide internally finned 3/8" copper tubes mechanically bonded to configured aluminum plate fin evaporator and condenser coils. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil and condenser coil shall be leak tested to 200 psig and pressure tested to 450 psig. Cooling coils shall be provided that do not carryover moisture with a 10% velocity safety factor.
F. The heating section shall have a drum and tube heat exchanger design using stainless steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. A negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful attempts, the entire heating system shall be locked out until manually reset at the thermostat. Unit shall be suitable for use with natural gas. All units shall have a minimum two-stage heating. VAV units shall have modulating burners with a minimum of 5:1 turndown.
G. The outdoor fans shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and have built-in thermal overload protection.
H. Unit shall have belt driven, FC centrifugal fans with adjustable motor sheaves. Unit shall have an adjustable

idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. Oversized motors shall be available for high static operations. Refer to schedule.

I. Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Micro-processor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures.
J. Provide minimum 14” tall roof curb designed to mate with the downflow unit and provide support and a watertight installation. Verify thickness of insulation at each unit and provide curb extension or taller curb to maintain top of curb a minimum of 10” above roof. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips. Provide sloped curb as required for level unit installation.
K. Provide circuit board to interface unit with specified controls.
L. Economizer shall be factory installed. The assembly includes - fully modulating 0-100 percent motor and dampers, barometric relief, 10% minimum position setting, preset linkage, wiring harness with plug and fixed dry bulb control.
M. Provide pleated media MERV 8 two-inch filters.
N. Provide unit with louvered hail guards.
O. When scheduled or called for, provide service receptacle as part of unit powered ahead of the disconnecting means with in-use cast iron cover.
P. SCHEDULES

1. See schedule on plans for capacity and additional characteristics

PART 3 EXECUTION

3.1. INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances.
B. Curb Support: Install transition roof curb on existing roof curb, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction.
C. Secure units to curb support with anchor bolts.
D. Coordinate height of curb with roof insulation thickness and roof slope to have a minimum of 10” above the finished roof level.

3.2. CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. All exterior control wiring shall be installed in conduit.
C. Install piping adjacent to machine to allow service and maintenance.
D. Gas Piping: Comply with applicable requirements in Division 22 Sections for Fuel Gas Piping. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
E. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.
F. Install ducts to termination in roof curb.
G. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
H. Ground equipment according to Division 26 Section "Grounding and Bonding."
I. 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. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

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.
5. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4. STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
18. Start refrigeration system in summer only.
19. Complete startup sheets and attach copy with Contractor's startup report.
20. Inspect and record performance of interlocks and protective devices; verify sequences.
21. Operate unit for an initial period as recommended or required by manufacturer.
22. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
23. Measure gas pressure on manifold.
24. Measure combustion-air temperature at inlet to combustion chamber.
25. Measure flue-gas temperature at furnace discharge.
26. Calibrate thermostats.
27. Adjust and inspect high-temperature limits.
28. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.

C. Start refrigeration system and measure and record the following:

1. Coil leaving-air, dry- and wet-bulb temperatures.
2. Coil entering-air, dry- and wet-bulb temperatures.
3. Outside-air, dry-bulb temperature.
4. Outside-air-coil, discharge-air, dry-bulb temperature.

D. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
E. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

1. Supply-air volume.
2. Return-air volume.
3. Relief-air volume.
4. Outside-air intake volume.

F. Simulate maximum cooling demand and inspect the following:

1. Compressor refrigerant suction and hot-gas pressures.
2. Short circuiting of air through outside coil or from outside coil to outside-air intake.

G. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

1. High-limit heat exchanger.
2. Warm-up for morning cycle.
3. Freezestat operation.

4. Economizer to limited outside-air changeover.
5. Alarms.

H. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.
I. Provide one spare set of clean filters and deliver to owner.

3.5. ADJUSTING

A. Adjust initial temperature and humidity set points.
B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION 237416

END OF DIVISION 230000

DIVISION 26
TABLE OF CONTENTS

SECTION 260010 – ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Electrical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

A. This DIVISION requires the furnishing and installing of complete functioning Electrical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.
B. Refer to Architectural, Structural and Mechanical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing conduit in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

A. The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 13300 W 98th Street, Lenexa, KS 66215, PHONE 913-492-2400, EMAIL admin@pkmreng.com.
B. Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.
C. When a word, such as “proper”, “satisfactory”, “equivalent”, and “as directed”, is used, it requires the Architect-Engineer’s review.
D. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.
E. "INSTALL" means to join, unite, fasten, link, attach, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.
F. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.
G. "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.
H. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
I. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.
J. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.4. QUALIFICATIONS

A. The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

A. The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.6. CONTRACT CHANGES

A. Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

A. Locations of equipment, conduit and other electrical work are indicated diagrammatically by electrical drawings. Layout work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturers shop drawings.
B. Study and become familiar with contract drawings of other trades and in particular general construction drawings and details in order to obtain necessary information for figuring installation. Cooperate with other workmen and install work in such a way to avoid interference with their Work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.
C. Any conduit, apparatus, appliance or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other Work caused by this contractor, subcontractor, workers or any cause whatsoever, shall be restored as specified for new work.
D. Do not scale electrical drawings for dimensions. Accurately layout work from dimensions indicated on Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.
B. The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

A. The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
B. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

A. Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

A. The intent of these specifications is to allow ample opportunity for the Contractor to use their ingenuity and abilities to perform the work to their and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.
D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.
E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.
F. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

1. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

G. Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. OPENINGS, ACCESS PANELS AND SLEEVES

A. This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all conduits passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed prevent entry and movement of rodents and insects. Contractor shall coordinate their work with all other trades.

1.13. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.14. EXTENT OF CONTRACT WORK

A. Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of electrical systems. In no case will claims for "Extra Work" be allowed for work about which Electrical Contractor could have been informed before bids were taken.

B. Where specific information for devices, lights or equipment shown on the plans is missing, provide an allowance in the contract amount for furnishing a product reasonably implied by the level of other devices, lights and equipment provided in the contract documents.

C. Electrical Contractor shall be familiar with equipment provided by other Contractors that require electrical connections and control. Follow circuiting shown on drawings for lighting, power and equipment connections.

D. Make required electrical connections to equipment provided under Architectural and Mechanical divisions of this project. Receive and install electric control devices requiring field installation, wiring, and service connection. Equipment supplied by the automatic temperature control contractor shall be installed by the mechanical or automatic temperature control subcontractor. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control systems for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. The cost for field modifications requiring rewiring of factory installed control systems for equipment provided by General or Mechanical Contractors shall be included in base bid of the respective contractor. All temperature control wiring shall be by a licensed electrician under the supervision of temperature control contractor.

E. Check electrical data and wiring diagrams received from Mechanical Contractor of compliance with project voltages, wiring, controls and protective devices shown on electrical drawings. Promptly bring discrepancies found to attention of Architect-Engineer for a decision.

F. Provide safety disconnect switches, contactors, and manual and magnetic motor starters for mechanical and electrical equipment requiring such devices. Omit these devices where included as part of factory installed prewired control systems provided with mechanical equipment. With exception of factory installed devices, provide safety disconnect switches, contacts and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.

G. To maximum extent possible electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

1.15. CODES, ORDINANCES, RULES AND REGULATIONS

A. Provide work in accordance with applicable rules, codes, ordinances and regulations of Local, State, Federal Governments, and other authorities having lawful jurisdiction.

B. Conform to latest editions and supplements of following codes, standards or recommended practices.

C. BUILDING CODES:

1. International Building Codes (Latest adopted version of applicable codes)

D. SAFETY CODES:

1. National Electrical Safety Code Handbook H30 - National Bureau of Standards
2. Occupational Safety and Health Standard (OSHA) Department of Labor

E. NATIONAL FIRE CODES AND STANDARDS:

1. NFPA No. 70 National Electrical Code
2. NFPA No. 72 National Fire Alarm and Signaling Code
3. NFPA No. 90A Air Conditioning & Ventilation Systems
4. NFPA No. 101 Life Safety Code

Commented [DT1]: Remove if no fire alarm system

F. UNDERWRITERS LABORATORIES INC.:

1. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

G. MISCELLANEOUS CODES:

1. ANSI A117.1 - Handicapped Accessibility
2. Americans with Disabilities Act (ADA)

H. ENERGY EFFICIENCY REQUIREMENTS:

1. All electrical systems and components shall be manufactured and installed in compliance with ASHRAE 90.1 – 2007 and latest adopted version of IECC.

1.16. STANDARDS

A. Drawings and specifications indicate minimum construction standard, should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect/Engineer in writing before proceeding with work so that necessary changes can be made. However, if Electrical Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

1.17. PERMITS/FEES

A. Electrical Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect/Engineer with request for final review.

B. Contractor shall include in bid any charges by local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exact which part of the work is to be performed by whom.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.1. SUBMITTALS

A. Contractor shall furnish submittals of all materials and equipment required by the specifications. Refer to each specification section for the submittals (if any) required for that section.

B. Submittal format shall be as indicated below. Submittals not meeting these requirements will be returned without action for re-submittal.

1. Submittals shall be furnished in an Adobe PDF format.
2. Submittals shall be per individual submittal section, as listed in the table of contents. All required submittals within that section shall be grouped together in a single submittal.

a. Furnishing submittals by division or by individual item may result in delayed reviewing of the submittal(s) due to additional administrative time required to process the large size and/or quantity of files.

3. Submittals shall have a cover page containing the following information: The project name, the applicable specification section and paragraph, the submittal date, and the Contractor's stamp (see below for requirements).
4. Mark each submitted item as applicable with scheduled mark, name, etc. corresponding to the plans.
5. Where generic catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Each catalog sheet shall bear the equipment manufacturer's name and address.
6. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization.
7. All submittals on materials and equipment listed by UL shall indicate UL approval on submittal.

C. Contractor review:

1. Contractor shall check all submittals to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All submittals submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All submittals not meeting Contractor's approval shall be returned to their supplier for re-submittal.
2. No submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.
3. Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

D. Review Schedule:

1. The shop drawing / submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus a duplication of this time for re-submittal if required.
2. Submittal of all shop drawings as soon as possible after permitting approval but before construction starts is preferred.
3. Approval of shop drawings submitted prior to receipt of a permit for that respective scope of work should be considered conditional pending review/approval of the construction documents by the AHJ. Changes required to the submittal as a result of permitting comments received after architect's/engineer's review shall not be a justification for a change in price.
4. Any time delay caused by correcting and re-submitting submittals/shop drawings will be the Contractor's responsibility.

E. The Architect's-Engineer's checking and subsequent review of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.
F. Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.
G. Submittals that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.
H. Coordination

1. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc) that will interface with installation. Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.

3.2. SHOP DRAWINGS

A. Shop drawings shall meet all of the above requirements for submittals.
B. Contractor shall submit Adobe PDF sets of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.
C. No work shall be fabricated until Architect-Engineer's review has been obtained.
D. Electrical equipment location and conduit coordination shop drawings for conduit fabrication and electrical equipment clearances shall be a minimum of 1/4" scale. Shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work.

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

A. Submit with shop drawings of equipment, three sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.
B. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.
C. Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
3. Record copy of all submittals indicating actual equipment installed indicating options, characteristics. Copies of submittals shall bear the stamps of all parties that reviewed submittals.
4. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of system.
5. Record Set Drawings: The Contractor shall mark up a set of contract documents during construction noting all changes and deviations including change orders. These will be delivered to Architect at end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.
6. Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

   a. Project name and address.
   b. Section of work covered by brochure, i.e., Electrical.

3.4. RECORD DOCUMENTS

A. During construction, keep an accurate record of all deviations between the work as shown on Drawings and that which is actually installed. Keep this record set of prints at the job site for review by the Architect/Engineer.
B. Upon completion of the installation and acceptance by the owner, transfer all record drawing information to one neat and legible set of prints. Then deliver them to the Architect/Engineer for transmittal to the Owner.

3.5. PREMIUM TIME WORK

A. The following Work shall be performed at night or weekend other than holiday weekends as directed and coordinated with the Owner.

1. All tie-in, cut-over and modifications to the existing electrical system and other existing system requiring tie-ins or modifications shall be arranged and scheduled with the Owner to be done at a time as to maintain continuity of the service and not interfere with normal building operations.

3.6. CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
B. Contractor shall clean up all fixtures and equipment at the completion of the project.
C. All switchboards, panelboards, wireways, trench ducts, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

3.7. WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense

3.8. CUTTING AND PATCHING

A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Remove walls, ceilings and floors (or portions thereof) necessary to accomplish scope of work. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.
B. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.
C. Patching shall be by the contractors of the particular trade involved, shall match the existing construction type, quality, finish and texture, and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of electrical work shall be repaired at Contractor's expense to approval of Architect-Engineer.

3.9. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown or specified. Level, shim, and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instruction. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
B. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
C. Provide electrical floor mounted equipment with 3-1/2" high concrete bases unless shown or specified otherwise. Electrical contractor shall size all pads. General contractor shall form all pads, provide and place all concrete for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.
D. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best recognized practice. Electrical contractor shall arrange for attachment to building structure, unless otherwise indicated on drawings or as specified. Provide hangers with vibration eliminators where required. Contractor shall verify that structural members of building are adequate to support equipment. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect/Engineer for review before proceeding with fabrication or installation.

3.10. START-UP, CHANGEOVER, TRAINING AND OPERATION CHECK

A. Electrical Contractor shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending and total hours of instruction given each individual.
B. All owner-training sessions shall be orderly and well organized and shall be video recorded digitally. At the end of the owner training, the "training" session recording shall be transmitted to the owner via DVD and shall become property of the owner.

3.11. FINAL CONSTRUCTION REVIEW

A. At final construction review, Electrical Contractor and the major sub-contractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by Architect/Engineer, that the work complies with purpose and intent of plans and specifications. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

END OF SECTION 260010

SECTION 260011 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1. NEUTRAL AND GROUND WIRES

A. Where individual circuit homeruns (hots, neutral, and ground as part of a single circuit) are indicated on the plans serving lighting and branch circuit receptacle loads, these shall be individual circuits with individual neutrals (no sharing of neutrals and/or grounds).
B. Where shared circuit homeruns (hots, neutral, and ground as part of separate circuits) are indicated on the plans, these shall be allowed to share one (common) ground for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional ground wires shall be installed. Conduit shall be upsized and conductors shall be de-rated based on NEC current carrying conductor tables, counting all hots and neutrals as current carrying conductors.

    1. No sharing of neutral conductors is allowed in multi-wire branch circuit homeruns, unless the installation meets the requirements of 2014 NEC 210.4(B), and is specifically approved by the engineer of record.

3.2. TESTS RECORDING, REPORTING TESTS AND DATA

A. Record nameplate horsepower, amperes, volts, phase service factor and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.
B. Record motor starter catalog number, size and rating and/or catalog number of thermal-overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specification for instructions for proper sizing of thermal-overload units.
C. Record amperes-per-phase at normal or near-normal loading of each item of equipment furnished and/or connected.
D. Record correct readings of each feeder conductor after energized and normally loaded, and again after balancing of feeder loads as required by current readings.
E. Record voltage and ampere-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load.
F. Short-Circuit Calculations

    1. Contractor shall contact utility company after utility company design is complete and determine exact available fault current in amperes at the point of utility connection (Service Point).
    2. Contractor shall utilize the above available fault current to calculate the available fault current in amperes (RMS-SYM) at the service equipment.
    3. The available fault current shall be labeled on the service equipment – refer to Section 260553.

G. Submit at least two (2) typewritten copies of data noted above to Architect-Engineer for review prior to final inspection.
H. Keep a record of all deviations made from routes, locations, circuiting, etc. shown on contract drawings. Prior to final inspection submit one new set of project drawings with all deviations and changes clearly indicated.

3.3. CLEANING AND PAINTING OF MATERIALS AND EQUIPMENT

A. Before energizing switchboards, transformers, panelboards, starters, variable frequency drive and other similar electrical equipment, Contractor shall thoroughly vacuum out all dirt, dust and debris from inside of equipment and shall thoroughly clean outside and inside of equipment.
B. Touch-up painting and refinishing of factory applied finishes shall be by Electrical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.
C. Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.
D. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to

factory materials. Finish coating shall be same color and type as factory finish.

E. Where extensive refinishing is required equipment shall be completely repainted.

3.4. FIRE BARRIERS

A. Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson “Flameseal” fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

B. Equivalent by Dow, Chemelex, 3M.

C. All holes or voids created by the electrical contractor to extend conduit or wiring through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

3.5. TEMPORARY COVERINGS

A. Provide temporary covering over all electrical panels, distribution panelboards, outlet boxes and other equipment as required to keep same free from damage due to moisture, plaster, paint, concrete or other foreign materials. Any equipment with finish damaged by moisture, paint, plaster or other foreign materials shall be cleaned and refinished as directed by the Architect without additional cost to the Owner.

B. All temporary openings in conduits shall be covered with metal or plastic caps.

3.6. PROTECTIVE COVERS

A. Provide protective wire guards over all wall mounted and ceiling mounted devices subject to damage in areas such as gymnasiums, shops and similar occupancies.

B. Provide lockable covers over thermostats and similar wall mounted devices where items are located in public spaces but should not be operable by the general public.

SECTION 260013 – PROJECT COORDINATION

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).
5. Wiring of equipment furnished by others

B. Each related sub-contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3. COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Delivery and processing of submittals.
2. Progress meetings.
3. Preinstallation conferences.
4. Project closeout activities.
5. Startup and adjustment of systems.

1.4. SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Format shall be PDF or other electronic format to facilitate multiple user commenting and sharing easily.
3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including project managers, superintendent and other personnel in attendance at Project site to the General Contractor and other major subcontractors. Identify individuals and their duties and responsibilities; list email addresses and telephone numbers. Update the list as required during the project if personnel change.

1.5. COORDINATION

A. Certain materials will be provided by other trades. Examine the Contract Documents and reviewed record Submittals to ascertain these general requirements. Contract Documents reflect a basis of design and may not reflect actual equipment or items being utilized.
B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.
C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.
D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
E. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the Architect/Engineer. Do not proceed with work that is incompatible with equipment provided.
F. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
G. Coordinate with the local Utility Companies to their requirements for service connections and provide all necessary materials, labor and testing.
H. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.
I. Conduct a coordination meeting after reviewing all other trade coordination drawings with other relevant trades. This meeting shall be held to prevent conflicts during construction. Each major relevant subcontractor shall attend this meeting. Report any potential conflicts or clearance problems to Architect/Engineer after meeting.
J. Adjust location of piping, ductwork, conduit, wiring, etc. to prevent interferences, both anticipated and encountered. Determine the exact route and location of each item prior to fabrication.

1. Right-of-Way:

a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

1.6. DRAWINGS AND FILES.

A. The Drawings show only the general run of MEP systems, equipment, fixtures, piping and ductwork and other components as well as approximate location of items such as outlets, switches, diffusers, lights, and equipment connections, etc. Coordinate all exact locations of items with other trades, architectural elevations, equipment requirements, owner requirements, ceilings, access, serviceability, etc. All such modifications and coordination shall be made without additional cost to the Owner. Any significant changes in location of items necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made
B. Wherever the work is of sufficient complexity, additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the

area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field. Attend meetings with other trades to review all documents.

C. When directed by the General Contractor for areas of necessary coordination provide 3D building modelling coordination files and documents with other trades. Transmit information electronically and attend meetings as directed by the G/C as well as take part in coordination activities and documentation. Contractor shall be required to generate their own electronic files for this process.

1.7. PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Space and access limitations.
o. Regulations of authorities having jurisdiction.
p. Testing and inspecting requirements.
q. Installation procedures.
r. Coordination with other work.
s. Required performance results.
t. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other

items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to Construction Schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.

b. Review present and future needs of each contractor present, including the following:

i. Interface requirements.
ii. Sequence of operations.
iii. Status of submittals.
iv. Deliveries.
v. Off-site fabrication.
vi. Access.
vii. Quality and work standards.
viii. Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8. REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI.

1. Submit Contractor's suggested solution(s) to RFI. If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
2. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

3.1. EQUIPMENT FURNISHED BY OTHERS

A. Description:

1. Items furnished by other trades (mechanical or plumbing contractor, etc.) such as mechanical/plumbing equipment, line voltage actuators, VFDs (not by electrical contractor), etc.
2. Kitchen equipment (may be furnished by owner, owner’s vendor, or separate sub-contractor)
3. Equipment furnished by general contractor
4. Equipment furnished by owner

B. General

1. Fully review manufacturer’s installation instructions for equipment. Installation of all related electrical items noted below shall be per same.

a. Electrical contractor shall obtain same from others if not readily available.

C. Disconnecting Means

1. An approved disconnecting means shall be provided at all equipment and shall serve to disconnect power from same.
2. Disconnecting means may be a switch, circuit breaker, or a cord-and-plug type connection.
3. Disconnecting means shall be within sight of equipment, as defined by NEC.
4. Disconnect switches may be non-fused, unless specifically shown fused on the plans or otherwise required by code to be fused.

a. All disconnect switches serving elevator equipment shall be provided with an overcurrent protective device.

D. Wiring of Equipment

1. Wire sizes used shall be as directed on plans or installation instructions, whichever is greater. Contractor shall notify engineer of any deviations from wire sizes listed on construction documents.

2. Wiring shall include a neutral conductor where shown on plans or required by installation instructions.
   a. If a neutral conductor is shown on the plans but not required by installation instructions, verify removal of neutral wire with engineer via RFI prior to proceeding.
3. Wiring of elevators and other such equipment shall account for voltage drop limitations of equipment.
4. Wiring of VFDs shall be as follows:
   a. Secondary VFD cables shall be symmetrically shielded and grounded or, where the length of the conductors is less than the VFD manufacturer's recommended maximum, be copper conductors installed in metallic conduit. Same shall not be installed in the same raceway as other cables or combined in wire gutters or cable trays

END OF SECTION 260013

SECTION 260505 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SCOPE

A. Demolition work to be performed whether shown or not on the drawings. Disconnect and remove any lights, equipment, conduit, wiring, devices, etc. not required to remain and/or required to be removed to accommodate new construction.

1.3. SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of the following:

a. Mechanical and electrical equipment, devices, piping, conduits, ductwork, insulation, lighting, etc in existing building as required to accommodate new construction.
b. Removal of MEP items in interior partitions.
c. Removal and protection of existing fixtures, materials, and equipment items to be removed, salvaged, relocated, reinstalled, etc.

1.4. SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Schedule indicating proposed sequence of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed remodeled areas.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Architect prior to start of work.

1.5. JOB CONDITIONS

A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in such a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of Contractor's inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.
D. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.

a. Provide protective measures as necessary and required to provide free and safe passage of Owner's personnel and general public to any occupied portions of building.
b. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
c. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
d. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.

e. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
f. Remove protections at completion of work.

2. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
3. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

E. Flame Cutting:

1. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

G. Maintain fire protection services during selective demolition operations.
H. Environmental Controls:

a. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing and/or approved regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1. PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
B. Cease operations and notify Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
C. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to any occupied portions of the building.

a. Where selective demolition occurs immediately adjacent to any occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation as required by Architect.
b. Provide weatherproof closures for exterior openings resulting from demolition work.

D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to any occupied areas of building. Provide minimum of 72 hours advance notice to Architect if shutdown of service is necessary during changeover.

3.2. DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
3. Provide services for effective air and water pollution controls as required.
4. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of

approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to architect in written accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3. SALVAGED MATERIALS

A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain a receipt.

3.4. DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.
B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
C. Burning of removed materials is not permitted on Project site.

3.5. CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 260505

SECTION 260519 – WIRE AND CABLE

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3. SUBMITTALS

A. Product Data: For each type of product indicated.
B. Qualification Data: For testing agency.
C. Field quality-control test reports.

1.4. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

1.5. COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1. CONDUCTORS AND CABLES

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

1. Southwire Company.
2. General Cable Corporation.
3. Encore Wire Corporation.
4. AFC Cable Systems, Inc. (Multiconductor cable only)

B. Copper Conductors: Comply with NEMA WC 70.
C. Aluminum Conductors: Comply with NEMA WC 70.
D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN-2.

1. Provide consistent color coding of all circuits as follows:

	Distribution System		
Phase	**120/208**	**277/480**	**Isolated Power Systems [2]**
A	Black	Brown	(L2) Brown w/ Stripe [3,5]
B	Red	Orange	-
C	Blue	Yellow	-
N	White	Gray	(L1) Orange w/ Stripe [3,4]
Ground	Green	Green w/ Stripe [1]	Green w/ Stripe [3]

Notes:

1) Stripe shall be white or yellow in color.
2) "Isolated Power System" as referenced by NEC 517.160 for anesthetizing locations.

E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2. CONNECTORS AND SPLICES

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

Commented [DT2]: Delete table column if not using isolated power systems

1. Cable manufacturers listed above under 2.1, Item A.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1. CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

1. Aluminum conductors acceptable only when specifically shown/scheduled on drawings.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

1. Aluminum conductors are not permitted for branch circuit wiring.

3.2. CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Provide insulation / cable types for conductors as follows:

Application	Insulation / Cable Type		
	THHN/THWN-2 [1]	XHHW-2 [1]	MC Cable [3]
Service Entrance	X [2]	X	
Feeders:			
Exposed, Exterior	X [2]	X	
Exposed, Interior	X		
Concealed in Ceilings, Walls, Partitions, and Crawlspaces	X		
Concealed in Concrete, below Slabs-on-Grade, and Underground	X [2]	X	
Branch Circuits:			
Exposed, Exterior	X [2]	X	
Exposed, Interior - Including Crawlspaces	X		
Concealed in Ceilings, Walls, and Partitions	X		X
Concealed in Concrete, below Slabs-on-Grade, and Underground	X [2]	X	
Isolated Power Systems		X	

Notes:

1) Single conductors in raceway. Refer to Section 260533 - Raceway & Boxes for acceptable raceway types/applications.
2) THHN/THWN-2 is acceptable for these installations at contractor's discretion.
3) Metal Clad (MC) cable installations shall be in accordance with the following:
   (i) MC cable shall not be used for homeruns.
   (ii) MC cable may be used for light fixture and equipment whips in lengths no longer than 6'-0". The use of MC cable from lighting fixture to lighting fixture shall not be allowed.
   (iii) MC cable shall not be installed in exposed locations for lighting purposes. MC cable may be exposed in mechanical spaces for equipment whips.

B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
C. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.
D. Class 2 Control Circuits: Type THHN-THWN-2, in raceway or Power-limited cable, concealed in building finishes.

3.3. INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Support cables per National Electrical Code requirements.
F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4. CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
    1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

Commented [DT3]: Remove unless using aluminum

3.5. FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
B. Tests and Inspections:
    1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
    2. Test Reports: Prepare a written report to record the following:
        a. Test procedures used.
        b. Test results that comply with requirements.
        c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 – GROUNDING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. Provide grounding electrodes, conductors, connections and equipment to provide a solidly grounded electrical system.

1.3. STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

1. Underwriters Laboratory Standard No. U.L. 467.
2. ANSI C-1 1978.
3. IEEE Standards No. 142-1982, 1100-1992 and No. 80.
4. National Electrical Safety Code.
5. NFPA.

1.4. SUBMITTALS

A. Submit test reports certifying resistance values for buried or driven grounds and water pipe grounds.

PART 2 - PRODUCTS

2.1. MATERIALS

A. Ground Cables: green color coded, insulated, annealed stranded tinned copper wire as indicated on Drawings; insulated wire to conform with requirements of Section 16120.
B. Mechanical Connectors: Tin-plated aluminum alloy, UL approved and stamped for use with aluminum or copper conductors.

2.2. GENERAL

A. Grounding systems shall be installed in accordance with the requirements of the local authorities, and subject to the approval of the Architect/Engineer.
B. All ground wires and bonding jumpers shall be stranded copper installed in conduit. All ground wires shall be without joints and splices over its entire length.
C. The system neutral shall be grounded at the service entrance only, and kept isolated for grounding systems throughout the building.
D. Each system of continuous metallic piping and ductwork shall be grounded in accordance with the requirements of the National Electrical Code.
E. Mechanical equipment shall be bonded to the building equipment grounding system. This shall include but is not limited to, fans, pumps, chillers, etc.
F. PVC conduits and portions of metallic piping and duct systems which are isolated by flexible connections, insulated couplings, etc., shall be bonded to the equipment ground with a flexible bonding jumper, or separate grounding conductor.
G. Metal raceways, cable trays, cable armor, cable sheath, enclosures, frames, fittings and other metal noncurrent-carrying parts that are to serve as grounding conductors shall be effectively bonded where necessary to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary.

2.3. RECEPTACLES

A. Receptacles shall be grounded to the outlet box by means of a bonding jumper between the outlet box and the receptacle grounding terminal.

2.4. CONCENTRIC KNOCKOUTS

A. Provide grounding type bushings for conduits terminated through multiple concentric knockouts not fully knocked out, on inside of electrical enclosures. Install bonding jumper between ground bushing and enclosure

PART 3 - EXECUTION

3.1. INSTALLATION

A. Ground Conductors:

1. Size as shown on Drawings or as required by National Electrical Code. Grounding conductors shall be as shown on plans or if not specifically shown shall be no smaller than that required by the NEC.
2. Where ground cables are required, install insulated copper ground conductors in steel conduit, or as indicated.
3. Where ground cable is installed in metallic conduit, bond cable to conduit at both ends.
4. Connect ground conductors in cables and in conduit to appropriate ground buses (as in switchgear, motor control centers, and distribution panelboards) or directly to metallic enclosure if no ground bus is provided.

B. Conduit Attachment to Electrical Equipment:

1. Ground conduits to metal framework of electrical equipment with double locknuts or grounding bushings and bonding jumpers unless otherwise noted.
2. Install bonding jumpers at all electrical equipment to provide continuous ground return path through conduit.
3. Install bonding jumpers across expansion fittings between conduit sections for ground path continuity.
4. Bond conduits to cable tray where conduit enters or exits tray.
5. Equipment grounding conductors for branch circuit home runs shown on the drawings shall indicate an individual and separate ground conductor for that branch circuit which shall be terminated at the branch circuit panelboard, switchboard, or other distribution equipment. No sharing of equipment grounding conductors sized according to the size of the overcurrent device and NEC Table 250-122 shall be allowed.
6. Required equipment grounding conductors and straps shall be sized in compliance with N.E.C. Table 250-122.
7. Equipment grounding conductors shall be provided with green type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors.
8. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus. Installation shall include necessary precautions regarding terminations with dissimilar metals.

C. Circuiting

1. Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or three-phase feeder.
2. Single phase 120 volt branch circuits for lighting and power shall consist of phase and neutral conductors and a green ground conductor installed in common metallic conduit which shall serve as grounding conductor.
3. Provide flexible metallic conduit utilized in conjunction with above single phase branch circuits with suitable green insulated grounding conductors connected to approved grounding terminals at each end of flexible conduit.
4. Single phase branch circuit installed in nonmetallic conduits shall be provided with separate grounding conductor.
5. Install grounding conductor in common conduit with related phase and/or neutral conductors.
6. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

D. Receptacles and Switches:

1. Install bonding jumpers between outlet box and receptacle grounding terminal except where contact device or yoke is provided for grounding purposes.

E. Wireways:

1. Install grounding jumpers for bonding between wireway and other panelboards, conduit, switchgear,

motor control centers, and at any other point where solid connection would otherwise not provided in supporting system to insure continuous ground.

F. Pull Boxes, Junction Boxes and Enclosures:

1. Connect all equipment grounding conductors together and connect to the box.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3. DEFINITIONS

A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. RMC: Rigid metal conduit.

1.4. PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5. QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Comply with NFPA 70.

1.6. COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.1. SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

i. Hilti Inc.
ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
iii. MKT Fastening, LLC.
iv. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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

i. Cooper B-Line, Inc.; a division of Cooper Industries.
ii. Empire Tool and Manufacturing Co., Inc.
iii. Hilti Inc.
iv. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
v. MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2. FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1. APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
B. Support raceways at intervals no greater than ten (10) feet and with one support within three (3) feet of each coupling, box, fitting, or outlet box. Provide one support within three (3) feet of each elbow or bend.
C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 20 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and

smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2. SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel:

   a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
   b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
   c. Spring-tension clamps].

7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3. INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

SECTION 260533 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. Provide complete raceways systems, boxes and fittings for all required electrical systems.

1.3. STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

1. Rigid Steel Conduit

a. U.L. Standard UL-6
b. A.N.S.I. C80-1
c. Federal Specification WW-C-581E

2. Intermediate Metallic Conduit

a. U.L. Standard UL-1242
b. Federal Specification WW-C-581E

3. Electrical Metallic Tubing

a. U.L. Standard UL-797
b. A.N.S.I. C80-3
c. Federal Specification WW-C-563

4. Flexible Steel Conduit

a. U.L. Standard UL-1

5. Liquid Tight Flexible Conduit

a. U.L. Standard UL-360

6. Non-Metallic Conduit

a. U.L. Standard UL-651
b. A.N.S.I. Standard F512
c. N.E.M.A. Standard TC-2
d. Federal Specifications GSA-FSS and W-C-1094-A

7. Wireways and Auxiliary Gutters

a. U.L. Standard UL-870

8. Rigid Aluminum Conduit

a. A.N.S.I. C80.5

1.4. SUBMITTALS

A. Provide manufacturer's catalog cuts of fittings.
B. Where wireways and/or auxiliary gutters are employed full erection drawings must be submitted. Drawings to include plan views, elevations, size of wireways, type and quantity of conductors proposed to be installed therein, etc.
C. Indicate duct banks or multi-trade coordinated shop drawings.
D. Submit shop drawings or catalog descriptive data on boxes exceeding twenty-four (24")inches for any one dimension.
E. Submit shop drawings or catalog descriptive for floor boxes and accessories.

PART 2 - PRODUCTS

2.1. RACEWAY TYPES

A. Standard Threaded Rigid Steel Conduit.

1. Rigid conduit heavy wall galvanized.
2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.

B. Intermediate Metallic Conduit

1. Light weight rigid steel conduit.
2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.

C. Electrical Metallic Tubing

1. Continuous, seamless tubing, galvanized or sheradized on the exterior, coated on the interior with a smooth hard finish of lacquer, varnish, or enamel.
2. Couplings and connectors:
    a. Indoor and two (2") inches in size and smaller, shall be steel set-screw type fittings.
    b. 2-1/2 inch size and larger must employ steel compression gland fittings.
    c. Outdoor shall be raintight steel compression gland fittings.
3. Indent type fittings shall not be used.
4. All connectors shall have insulated throat.
5. Where installed in slab or concrete work, provide approved concrete tight fittings.

D. Flexible Steel Conduit

1. Single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel.
2. Maximum length: (six 6) feet.
3. Each section of raceway must contain an equipment grounding wire bonded at each end and sized as required. Provide connectors with insulating bushings.
4. Steel squeeze-type or steel set screw type fittings.

E. Liquid Tight Flexible Electrical Conduit

1. Same as flexible steel conduit except with tough, insert water-tight plastic outer jacket.
2. Cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat.

F. Wireways and Auxiliary Gutters

1. Painted steel or galvanized steel.
2. Of sizes and shapes indicated on the Drawings and as required.
3. Provide all necessary elbows, tees, connectors, adapters, etc.
4. Wire retainers not less than twelve (12") inches on center.

G. Aluminum Conduit

1. Do not use aluminum conduit unless specifically indicated on the drawings for special purposes.

2.2. LOCKNUTS AND BUSHINGS

A. Locknuts shall be steel. Die cast locknuts shall not be used.
B. All bushings shall be insulated. Use nylon insulated metallic bushings for sizes 1" and larger. Plastic bushings may be used in 1/2" and 3/4" sizes.

2.3. OUTLET, JUNCTION, AND PULL BOXES

A. Cast Type Conduit Boxes, Outlet Bodies and Fittings

1. Provide surface mounted outlet and junction boxes, in indoor locations, where exposed to moisture and in outdoor locations.
2. Use Ferrous Alloy boxes and conduit bodies with Rigid Steel or IMC.
3. Use Ferrous Alloy or cast aluminum boxes and conduit bodies with Electrical Metallic Tubing.
4. Covers: Cast or sheet metal unless otherwise required.

5. Tapered threads for hubs.

B. Galvanized Pressed Steel Outlet Boxes

1. General

a. Pressed steel, galvanized or cadmium-plated, minimum of four (4") inches, octagonal or square, with galvanized cover or extension ring as required.

2. Concrete Box

a. Four (4") inch octagon with a removable backplate and 3/8" fixture stud, if required. Depth of box shall allow for a minimum of one (1") inch of concrete to be poured above the backplate.

3. Switch and Receptacle Box, Indoors

a. Nominal four (4") inches square, 1-1/2" or 2-1/2" deep as required, with raised cover unless otherwise indicated on drawings. Gangable boxes shall not be used.

4. Plug any open knockouts not utilized.

C. Sheet Steel Boxes Indoors

1. No. 12 USS gauge sheet steel for boxes with maximum side less than forty (40") inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4 inch flanges at exterior corners.
2. No. 10 USS gauge sheet steel for boxes with maximum side forty (40") to sixty (60") inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4 inch flanges at exterior corners.
3. No. 10 USS gauge sheet steel riveted or welded to 1-1/2 by 1-1/2" by 1/4" welded angle iron framework for boxes with a maximum side exceeding sixty (60") inches and more than 1,500 square inches in area.
4. Covers

a. Same gauge steel as box.
b. Subdivided single covers so no section of cover exceeds fifty (50) pounds.
c. Machine bolts, machine screws threaded into tapped holes, or sheet metal screws as required; maximum spacing twelve (12") inches.

5. Paint

a. Rust inhibiting primer; ANSI No. 61 light gray finish coat.

6. Where size of box is not indicated, size to permit pulling, racking and splicing of cables.
7. For Boxes over 600 Volts

a. Provide insulated cable supports and removable steel barriers to isolate each feeder. Stencil cable voltage class in red letters on the front cover of the box.
b. Braze a ground connector suitable for copper cables to the inside of the box.

D. Pull and Splice Boxes, Outdoors

1. Aluminum reinforced, with removable covers secured by brass machine screws.
2. Where size of box is not indicated, size to permit pulling, racking, and splicing of the cables.
3. Braze a ground connector suitable for copper cables to the inside of the box.

PART 3 - EXECUTION

3.1. APPLICATION OF RACEWAYS

A. The following applications must be adhered to except as otherwise required by Code. Raceways not conforming to this listing must be removed by this Contractor and replaced with the specified material at this Contractors expense.

1. Rigid Steel - Application: Where exposed to mechanical injury, where specifically required, exterior exposed locations, and where required by codes and for all circuits in excess of 600 volts.
2. I.M.C. - Application: Same as standard threaded rigid steel conduit.
3. E.M.T. - Applications: Use in every instance except where another material is specified. EMT shall not be used underground or in slab on grade.
4. Flexible Steel - Applications: Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at bus duct takeoffs, at all transformer or equipment raceway connections where sound and vibration isolation is required.

5. Liquid-Tight Flexible Conduit - Applications: Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas.
6. Non-Metallic Conduit - Application: Schedule 40 - Where specifically indicated on the drawings and for raceways in slab or below grade. All bends shall be made with steel elbows and wrapped unless the bend is encased in concrete.
7. Wireways and Auxiliary Gutters - Application: Where indicated on the Drawings and as otherwise specifically approved.

3.2. RACEWAY SYSTEMS IN GENERAL

A. Provide raceways for all wiring systems, including security, data transmission, paging, low voltage et. al. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Wiring of each type and system must be kept independent and installed in separate raceways – including, but not limited to:

1. Wiring of different voltages (480/277V vs. 208/120V)
2. Emergency / Normal Wiring (except as permitted by NEC 700)

B. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Lay out the work in advance to avoid excessive concentrations of multiple raceway runs.

C. Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install one (1") inch or larger raceways, in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect/Engineer. Draw up couplings and fittings full and tight.

D. Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Minimum conduit size shall be 3/4”.

E. Above-grade raceways to comply with the following:

1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of six (6") inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run concealed raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs, and partitions for passage of raceways. Waterproof sleeved raceways where required.
2. Raceways shall not be run on roofs or exposed on the outside of the buildings unless specifically noted as exposed on the drawings or approved by the Architect/Engineer.
3. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction. Provide expansion fittings every 200 feet on outdoor conduit.
4. Provide one (1) empty 3/4 inch raceway for each three (3) spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.
5. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling, or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.
6. Provide pull string in spare or empty raceways. Allow five (5) feet of slack at each end and in each pull box. Tie each end of the string to a washer or equivalent that does not fit into the conduit. Tag both ends of string denoting opposite end termination location.

F. No raceway may be installed in a concrete slab or members except with the permission of the Structural Engineer and with the written consent of the Owner.

1. Conduits embedded in structural concrete slabs shall have an outside diameter less than one third of the thickness of the concrete slab and shall be installed entirely within the center one third of the concrete slab.
2. Raceways embedded in concrete slabs shall be spaced not less than eight (8") inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
3. In no case will installation of raceways be permitted to interfere with the proper placement of principal

reinforcement.

4. Raceways running parallel to slab supports, such as beams, columns, and structural walls, shall be installed not less than twelve (12") inches from such supporting elements.
5. To prevent displacement during concrete pour of lift slab, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured with suitable adhesives.

G. Non-metallic raceway installation shall conform to the following:

1. All joints are to be made by the solvent cementing method using the material recommended by the raceway manufacturer. To insure good joints, components shall be cleaned prior to assembly.
2. Raceway cut-offs shall be square and made by handsaw or other approved means which does not deform the conduit. Raceway shall be reamed prior to solvent cementing to couplings, adapters, or fittings.
3. Electrical devices which are served by PVC raceways shall be grounded by means of a ground wire pulled in the raceway.
4. Bends shall be made by methods that do not deform or damage the conduit. The radii of field bends shall not be less than those established by the N.E.C.
5. Raceway expansion fittings shall be provided where necessary. The position of the expansion fitting shall be adjusted proportional to the temperature at installation.
6. Raceway supports shall be installed, in such a manner, to allow the PVC conduit to slide through the supports as the temperature changes.
7. Elbows must be galvanized rigid steel, intermediate metallic conduit or concrete encased. Plastic conduit may only be used for exterior underground applications or circuits beneath slabs on grade. Provide galvanized rigid steel (GRS) radius bends and risers as conduits rise above grade or above floor slab.
8. Provide exterior underground conduit with metal detection strip.
9. Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.
10. Joining and bending of conduit and installation of fittings shall be done only by methods recommended.
11. Provide conduit support spacing as recommended for the highest ambient temperature expected.
12. Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.
13. Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.
14. Test workmanship by conducting a low-pressure air (3.0-5.0 psi) test after system is installed and cemented joints are set. Plug and block ends to prevent movement prior to pressurization. Check for leaks at all joints with a soap solution. Even low-pressure air can cause high thrust loads and caution must be observed. The test shall be observed by the architect, engineer or owner's representative, prior to backfill. All below grade conduit that could potentially drain water into electrical equipment (ie. Main electrical service located in basement below utility transformer) must be watertight.

H. Raceways in hung ceiling shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars, Z-bars, or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than 1'-0" above hung ceilings.

I. Exposed raceways shall be run parallel or at right angles with building lines.

J. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt, or similar material. This assembly may be pulled in together with, but ahead of, the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ball mandrel.

3.3. OUTLET, JUNCTION, AND PULLBOXES

A. Provide outlet, junction, and pullboxes as indicated on the drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables.

1. J-boxes and pullboxes shall be sized per electrical code minimum.
2. Boxes on empty conduit systems shall be sized as if containing conductors of #4 AWG.
3. Wiring systems required to have separate/independent raceways (See Section 3.2 above) shall also be provided with separate junction and pull boxes. These wiring systems may occupy the same outlet box only if a divider is installed between the wiring that is listed for this purpose.

B. Install boxes and covers for wiring devices so that the wiring devices will be installed with a vertical orientation unless otherwise noted on the drawings.

C. The exact location of outlets and equipment is governed by structural conditions and obstructions, or other

equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.

D. Pull Box Spacing

1. Provide pull boxes so no individual conduit run contains more than the equivalent of four (4) quarter bends (360 degrees total).
2. Conduit Sizes 1-1/4" and Larger.
    a. Provide boxes to prevent cable or wire from being excessively twisted, stretched, or flexed during installation.
    b. Provide boxes for medium voltage cables so that maximum pulling tensions do not exceed cable manufacturer's recommendations.
    c. Provide support racks for boxes with multiple sets of conductors do not rest on any metal work inside box.
3. Conduit Sizes one (1") inch and smaller, low voltage wire and cable (maximum distances)
    a. 200 feet straight runs.
    b. 150 feet runs with one 90 degree bend or equivalent.
    c. 125 feet runs with two 90 degree bends or equivalent.
    d. 100 feet runs with three or four 90 degree bends or equivalent.

END OF SECTION 260533

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. A. Provide identification on all equipment, raceways, boxes and conductors.

PART 2 - PRODUCTS

2.1. NAMEPLATES

A. Nameplates shall be lamacoid plates with engraved upper-case letters and beveled edges.
B. Color:

1. Normal-power equipment shall have white nameplates with black letters, enclosed by a black border.
2. Equipment fed from the emergency electrical system, or otherwise designated on the plans for emergency use, shall have red nameplates with white letters, enclosed by a white border.
3. Nameplates for short circuit ratings and calculations shall be yellow with black letters, enclosed by black border.

C. All nameplates shall be engraved and must be secured with rivets, brass or cadmium plate screws. The use of Dymo tape or the like is unacceptable.
D. Nameplate inscriptions shall bear the name and number of equipment to which they are attached as indicated on the Drawings. The engineer reserves the right to make modifications in the inscriptions as necessary.

2.2. CABLE TAGS AND WIRE IDENTIFICATION LABELS

A. Cable tags shall be flameproof secured with nylon ties.
B. Wire markers shall be preprinted cloth tape type or approved equivalent.

2.3. IDENTIFICATION LABELS

A. Acceptable Manufacturers

1. W.H. Brady Company (Style A)
2. Thomas & Betts Company (T&B), Style A.
3. Seaton

B. Plasticized Cloth

1. Non-conductive.
2. Waterproof.
3. Capable of withstanding continuous temperatures of 235 degrees F and intermittent temperatures to 300 degrees F.
4. Overcoating for protection against oil, solvents, chemicals, moisture, abrasion and dirt.

C. Heavy, thermo-resistant industrial grade adhesive, for adhesion of label to any surface without curling, peeling or falling off.
D. Label Designations, Nominal System Voltages Applied to the covers of all medium and low voltage pull, splice and junction boxes.
E. Machine printed.

PART 3 - EXECUTION

3.1. INSTALLATION

A. Disconnect Switches.

1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation which the disconnect serves and the panel and circuit the switch is fed from.

B. Disconnect Switches.

1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation which the disconnect serves.

   a. Example:

   AHU – 1
   FED FROM PANEL LP-1 – 32

2. Nameplate shall be mounted at the top of the disconnect.

C. Motor Controllers.

1. Furnish and install a nameplate for each motor controller or combination motor controller for both individual motor controllers and those in a motor control center. Engraving must indicate the motor served and the type of service (e.g., AC-8-1st floor supply, EF-2 electric closet exhaust.)

D. Remote Smoke Detector Lamps and Test Stations.

1. Furnish and install a nameplate on each remote smoke detector lamp and/or test station.
2. Engraving must indicate the location of the device to which the lamp is connected, as approved by the Engineer.

E. Receptacles.

1. Furnish and install a clear typed label on each faceplate for each receptacle indicating panel and circuit.

   a. Example:

   LP-1/32

2. Label shall be mounted at the top of the faceplate.

F. Pullboxes, Enclosures, and Cable Terminations.

1. Circuits rated over 40 Amp and all cables over 600V:

   a. Provide identification label with circuit numbers on enclosure cover.
   b. Furnish and install cable tags on each cable that enters a pullbox, enclosure, switchboard, and at terminations. Mark tags with type written inscription noting the load served, type and size of cable, and the overcurrent device protecting the cable.

G. Branch circuits:

1. Provide identification label with panel and circuit numbers on enclosure cover.
2. Identify each circuit with wire markers when enclosure label and wire colors do not provide enough information to identify each circuit without tracing.
3. Provide feeders and branch circuit home runs with plasticized wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.
4. 4 square box covers hidden above lay-in ceilings may be marked with indelible ink marker in lieu of using printed labels.

H. Warning Signs

1. Provide electrical equipment and accessible wiring enclosures operating at voltage above 240 volts with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications “Danger High Voltage” warning sign and voltage marker applied to front door or cover of device or enclosure.
2. Provide large equipment such as transformers and main distribution equipment with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications indicating all electrical characteristics.

I. Boxes

1. Provide identification labels for all low voltage and medium voltage pull, splice and junction boxes in main feeder and subfeeder runs, indicating nominal system voltage.
2. Apply labels after painting of boxes, conduits, and surrounding areas have been completed.

3. Clean surfaces before applying labels; clean aluminum surfaces with solvent wipe.
4. Apply labels on cover and minimum of one (1) fixed side; one (1) label visible from floor where boxes are Installed exposed.

END OF SECTION 260553

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1. GENERAL

A. Manufacturers

1. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

a. Eaton Wiring Devices; (may be listed below and/or submitted as Eaton, Cooper, Arrow Hart, or Crouse-Hinds).
b. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
c. Leviton Mfg. Company Inc. (Leviton).
d. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2. All devices shall be from the same manufacturer.

B. Finishes

1. Color: Wiring device catalog numbers in Section Text do not designate device color.

a. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.

i. Color shall be coordinated and verified with Architect and owner.

b. Wiring Devices Connected to Emergency Power System: Red.
c. Isolated Ground Devices: Orange.
d. TVSS Devices: Blue.
e. Controlled Devices: Green.

Commented [DT4]: Edit as necessary.
Suggest white when using vinyl coverplates (for residential or light commercial projects).

Commented [DT5]:
(Other color requirements, such as those in NEC 517, etc. may override and require removal of this “additional” color)

2.2. STRAIGHT BLADE RECEPTACLES

A. General Requirements for Convenience Receptacles

1. Unless otherwise modified below, all receptacles shall comply with the following:
2. Commercial / Common Areas: 125 V, 20 A
3. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
4. Multiple types of receptacles may be required of a single device (Ex.: a Hospital-Grade GFCI receptacle), as indicated on the plans and in the execution section below. Where such a device is required, it shall meet the requirements of all applicable sections below.
5. Products: Subject to compliance with requirements, provide one of the following:

a. Refer to list of approved manufacturers in general section.
b. Receptacle model/series(all manufacturers): 5361 (single), 5362 (duplex).

B. GFCI Receptacles

1. Straight blade, feed or non-feed-through type.
2. Include indicator light that is lighted when device is tripped.
3. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper; SGF20.
    b. Hubbell; GFRST20.
    c. Leviton; G5362.
    d. Pass & Seymour; 2097.
4. Where devices are shown labeled as GFI on drawings provide GFCI receptacle (feed-through devices are not acceptable unless otherwise noted, or with written permission from the engineer).
    a. Devices labeled as GFIP on the drawings may be protected as a feed-through device.

C. Weather-Resistant Receptacles

1. Receptacles shall UL-listed as weather-resistant.
2. Receptacles shall be identified with an “WR” on the receptacle face.
3. Products: Refer to General Requirements for Convenience Receptacles. WR receptacles shall be of same series.

2.3. WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Unfinished Spaces: Galvanized steel.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable in-use cover.

C. Emergency Devices

1. Coverplates for devices fed from emergency power shall be denoted as such with a device plate engraved with the word “EMERGENCY” in red capital letters.

PART 3 EXECUTION

3.1. INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Receptacle Types:

1. The following receptacle types shall be furnished in lieu of “standard” 120V, 15 or 20 amp receptacles

at all of the following locations, regardless of plan designation:

a. Refer to the National Electrical Code (NEC), for definitions of all locations listed below.

2. GFCI Receptacles:

a. Rooftops
b. Outdoors

3. Weather-Resistant Receptacles:

a. In all damp or wet locations.

E. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Wall plates shall not support wiring devices. Provide wiring device with accessories as required to properly install devices and wall plates.
11. All devices shall be flush-mounted except as otherwise noted on the drawings.
12. Locations

a. Comply with layout drawings for general location; contact Owner's Representative for questions about locations and mounting methods.
b. Relocate outlets obviously placed in a location or manner not suitable to the room finish.
c. Avoid placing outlets behind open doors.
d. Align devices vertically and horizontally. Device plates shall be aligned vertically with tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.

13. Mounting Heights as indicated on the Drawings and according to ADA requirements.
14. Ganging of Switches - provide barriers between ganged 277 volt switches of different phases.
15. Power Outlets - install power outlets complete with back boxes, where installed in existing buildings or extensions of existing buildings. Coordinate phase connections for rotating equipment with connections in existing building.
16. Install device plates on all outlet boxes. Provide blank plates for all empty, spare and boxes for future devices.
17. Caulk around edges of outdoor device plates and boxes when rough wall surfaces prevent a raintight seal. Use caulking material as approved by the Architect/Engineer.
18. Emergency/normal power devices and/or 277V/120V devices are not to occupy the same box. Where same are shown on plans to be ganged, provide separate boxes immediately adjacent to each other.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up.

G. Device Plates:

1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. Provide matching blank wall plates to cover outlet or junction boxes intended for future devices.
3. Provide matching blank wall plates with 4 port knock outs at all telephone, data, and tele/data outlet locations. Also provide with matching blankouts in each port.
4. Where wall plates for special devices are available only from manufacturer of device, provide designs and finishes equivalent to above specification.

5. Verify with Architect finish of any plate where it may be apparent a special finish or color should have been specified.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

3.2. IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3. FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.

B. Tests for Convenience Receptacles:

1. Test for correct wire terminations (no open ground, neutral, or hot).
2. Test for correct polarity (no hot/ground reverse or hot/neutral reverse).
3. Verify GFCI devices are operating properly.
4. Using the test plug, verify that the device and its outlet box are securely mounted.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.
D. Operation and maintenance data.

1.3. QUALITY ASSURANCE

A. 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.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1. DISCONNECT SWITCHES

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

1. Eaton (Cutler-Hammer)
2. General Electric Company
3. Siemens
4. Square D

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.2. MOLDED-CASE CIRCUIT BREAKERS

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

1. Eaton (Cutler-Hammer)
2. General Electric Company
3. Siemens
4. Square D

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
D. Electronic Trip Circuit Breakers (where indicated on drawings or elsewhere in this specification): Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

E. Features and Accessories (where called for or required):

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.3. ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
D. Install fuses in fusible devices.
E. Comply with NECA 1.

3.2. IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3. FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

END OF DIVISION 260000

ELECTRICAL SYMBOL LEGEND

SOME SYMBOLS AND ABBREVIATIONS ON THIS LEGEND MAY NOT BE USED

CIRCUITING

- HOME RUN (2#12 1#12G UNO)
- INDICATES 2 PHASE, 1 N, & 1 GRD CONDUCTOR
- HOME RUN: INDICATES SHARED CIRCUIT
- HOME RUN: INDICATES #10 CONDUCTORS ENTIRELY

UTILITIES

- ---- UGE --- UNDERGROUND ELECTRICAL
- —— OHE —— OVERHEAD ELECTRICAL
- —— TELE —— TELECOMMUNICATIONS CONDUIT
- ---- UGT --- UNDERGROUND TELECOMMUNICATIONS CONDUIT

LIGHTING

- GRID-MOUNTED TROFFER LIGHT FIXTURE
- STRIP LIGHT FIXTURE
- SURFACE/RECESSED LIGHT FIXTURE
- WALL-MOUNTED LIGHT FIXTURE
- POLE-MOUNTED LIGHT FIXTURE
- EXIT LIGHT
- BATTERY-OPERATED EMERGENCY LIGHT (WALL MTD)
- BATTERY-OPERATED EMERGENCY LIGHT (CEILING MTD)
- WALL-MOUNTED COMBINATION EXIT LIGHT/ BATTERY-OPERATED EMERGENCY LIGHT
- $ LIGHT SWITCH – SINGLE POLE
- $3 LIGHT SWITCH – 3-WAY
- $4 LIGHT SWITCH – 4-WAY
- $K LIGHT SWITCH – KEY
- $D LIGHT SWITCH – DIMMER
- $PL LIGHT SWITCH – PILOT LIGHT
- $2P LIGHT SWITCH – 2 POLE
- $D3 LIGHT SWITCH – 3-WAY DIMMER
- $M WALL-MOUNTED MOTION SWITCH
- M CEILING-MOUNTED MOTION SWITCH
- SB SWITCHBANK – REFER TO DETAILS
- FD1 DIMMER BOARD
- RCS-1 REMOTE CONTROL SWITCH AS SCHEDULED
- TC TIMECLOCK – REFER TO PLANS / DETAILS

EQUIPMENT

- DISCONNECT SWITCH. RE: PLANS FOR INFORMATION.
- MAGNETIC MOTOR STARTER
- COMBINATION DISCONNECT SWITCH / MOTOR STARTER
- TOGGLE-TYPE DISCONNECT. FURNISH WITH THERMAL MOTOR PROTECTION WHERE SERVING FANS/PUMPS.
- SURFACE PANELBOARD
- RECESSED PANELBOARD
- DISTRIBUTION PANELBOARD
- SWITCHBOARD. FEEDER/MAIN CIRCUIT BREAKER SECTION AND DISTRIBUTION SECTION.

GENERAL SYMBOLS

- INDICATES CONNECT TO EXISTING
- INDICATES ELEVATION
- XXX EQUIPMENT TAG. REFER TO CONNECTIONS SCHEDULE FOR ELECTRICAL CONNECTIONS AND LOAD INFO FOR KITCHEN, SHOP, ETC. EQUIPMENT

POWER DEVICES

- DUPLEX RECEPTACLE.
- LINE THRU DEVICE INDICATES ABOVE COUNTER
- GFI SPECIAL DUPLEX RECEPTACLE (GFCI, ISOLATED GROUND, ETC.)
- QUADPLEX RECEPTACLE
- 5-50R SIMPLEX RECEPTACLE W/NEMA CONFIG AS NOTED
- 5-50R MULTI-POLE RECEPTACLE W/NEMA CONFIG AS NOTED
- CEILING MOUNTED RECEPTACLE
- RECEPTACLE/DEVICE MOUNTED IN "TOMBSTONE"
- POKE-THRU WITH POWER
- POKE-THRU WITH TELECOMMUNICATIONS
- POKE-THRU W/POWER AND TELECOM
- 1G SINGLE GANG FLOOR BOX (2, 3, 4 GANG SIMILAR)
- DIVIDED POWER POLE
- C CLOCK RECEPTACLE
- PLUG MOLD / WIRE MOLD AS SPECIFIED
- J JUNCTION BOX
- PUSH BUTTON
- MOTOR

TELEPHONE/DATA

- TELEPHONE OUTLET (SINGLE-GANG BOX WITH (1) 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING)
- LINE THRU DEVICE INDICATES ABOVE COUNTER
- DATA OUTLET (DOUBLE-GANG BOX WITH (2) 3/4" CONDUITS TO ABOVE ACCESSIBLE CEILING)
- TELEPHONE/DATA OUTLET (DOUBLE-GANG BOX WITH (2) 3/4" CONDUITS TO ABOVE ACCESSIBLE CLG.)
- 1V PHONE OUTLET WITH NUMBER OF PHONE JACKS AS INDICATED – SEE DETAILS FOR ADD'L INFO.
- 1D DATA OUTLET WITH NUMBER OF PHONE JACKS AS INDICATED – SEE DETAILS FOR ADD'L INFO.
- 1D/1V PHONE/DATA OUTLET WITH NUMBER OF PHONE/DATA JACKS AS INDICATED – SEE DETAILS FOR ADD'L INFO.
- W WALL-MOUNTED WIRELESS INTERNET TRANSMITTER
- W CEILING-MOUNTED WIRELESS INTERNET TRANSMITTER

AUDIO/VISUAL

- TV TELEVISION OUTLET (SINGLE GANG BOX WITH (1) 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING)
- TR REVERSE TELEVISION OUTLET – CABLE TO HEAD END
- AV RECESSED COMBINATION AV AND POWER OUTLET COORD LOCATION OF DEVICE WITH TV MOUNT
- TDC TEACHER'S DESK CONNECTIONS – RE: DETAILS
- S WALL SPEAKER
- S CEILING SPEAKER
- S SUB CEILING SPEAKER – SUBWOOFER
- S SS CEILING SPEAKER – SOUND SYSTEM
- V VOLUME CONTROL
- SOUND SYSTEM AUDIO JACK
- RM REMOTE MICROPHONE CONTROL

COMMUNICATIONS SYMBOLS

- I INTERCOM CALL STATION
- INTERCOM HANDSET
- PAS PUBLIC ADDRESS SYSTEM AMPLIFIER
- IMS INTERCOM MASTER STATION
- S WALL SPEAKER – HORN TYPE
- S CEILING SPEAKER – HORN TYPE
- ECS ELEVATOR 2-WAY COMMUNICATION STATION
- ECM ELEVATOR 2-WAY COMMUNICATION MASTER STATION
- ECSP ELEVATOR 2-WAY COMMUNICATION POWER SUPPLY

FIRE ALARM

- F MANUAL PULL STATION
- D CEILING SMOKE DETECTOR
- D DUCT SMOKE DETECTOR
- H HEAT DETECTOR
- WF WATERFLOW SWITCH
- TS TAMPER SWITCH
- 75 WALL-MOUNTED FA STROBE WITH CANDELA RATING. 15cd RATING UNLESS OTHERWISE NOTED ON PLANS.
- WALL-MOUNTED FA HORN
- WALL-MOUNTED FA SPEAKER
- 30 WALL-MOUNTED FA HORN/STROBE WITH CANDELA RATING. 15cd UNLESS OTHERWISE NOTED ON PLANS.
- 30 WALL-MOUNTED FA SPEAKER/STROBE WITH CANDELA RATING. 15cd UNLESS OTHERWISE NOTED ON PLANS.
- 75 CEILING-MOUNTED FA STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
- CEILING-MOUNTED FA SPEAKER.
- 30 CEILING-MOUNTED FA HORN/STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
- 30 CEILING-MOUNTED FA SPEAKER/STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
- R RELAY
- FACP FIRE ALARM CONTROL PANEL
- FAAP FIRE ALARM ANNUNCIATOR PANEL
- FARA REMOTE ANNUNCIATOR PANEL
- FAEC FIRE ALARM EXTENDER CABINET
- DH DOOR HOLDER
- D 120V SINGLE / MULTI-STATION 120V SMOKE ALARM
- ZAM ZONE ADDRESSABLE MODULE
- IAM INDIVIDUAL ADDRESSABLE MODULE
- HFSS KITCHEN HOOD FIRE SUPPRESSION SYSTEM PANEL
- H KITCHEN HOOD REMOTE PULL STATION
- ARA AREA OF RESCUE ASSISTANCE STATION
- ARAM AREA OF RESCUE ASSISTANCE MASTER STATION

NURSE CALL

- N NURSE CALL STATION
- PC NURSE CALL EMERGENCY PULL CORD
- CB CODE BLUE STATION
- SS NURSE CALL STAFF STATION
- DB NURSE CALL DUAL PUSHBUTTON STATION (CODE BLUE / STAFF ASSIST)
- PM PATIENT MONITOR STATION
- DS NURSE CALL DUTY STATION
- DL NURSE CALL DOME LIGHT
- ZL NURSE CALL ZONE LIGHT
- NCM NURSE CALL MASTER STATION
- RCM RESIDENT CALL MASTER STATION
- PC RESIDENT CALL EMERGENCY PULL CORD

SECURITY

- FIXED CAMERA
- PTZ PAN/TILT/ZOOM CAMERA
- PROX PROXIMITY TYPE CARD READER
- CARD SWIPE CARD READER
- ES ELECTRIC STRIKE
- KP KEYPAD / MAG LOCK
- B BUTTON / MAG LOCK

MECHANICAL AND PLUMBING SYMBOL LEGEND

SOME SYMBOLS AND ABBREVIATIONS ON THIS LEGEND MAY NOT BE USED

SHEET METAL

- HIGH EFFICIENCY ROUND DUCT TAKEOFF (WITH & WITHOUT MANUAL DAMPER)
- SPIN-IN ROUND DUCT TAKEOFF (WITH & WITHOUT MANUAL DAMPER)
- CONICAL BELLMOUTH ROUND TAKEOFF
- ROUND DUCT RUNOUT WITH FLEX DUCT
- DUCTWORK ELBOW (WITH & WITHOUT TURNING VANES)
- XD FD:FIRE DAMPER FS:FIRE/SMOKE DAMPER SD:SMOKE DAMPER BD:BACKDRAFT DAMPER (GRAVITY)
- MD AUTOMATIC MOTORIZED DAMPER
- 8"Ø A 225 SUPPLY DIFFUSER AND DIFFUSER CALLOUT (NECK SIZE, TYPE AND CFM)
- LINEAR/SLOT DIFFUSER
- RETURN GRILLE OR EXHAUST REGISTER
- SUPPLY AIR FLOW INDICATOR
- RETURN AND EXHAUST AIR FLOW INDICATOR
- THERMOSTAT
- TEMPERATURE SENSOR
- H HUMIDISTAT
- CONTROL WIRING

MEDICAL GAS

- MV MEDICAL VACUUM PIPING
- O OXYGEN PIPING
- NO NITROUS OXIDE PIPING
- SA MEDICAL COMPRESSED AIR PIPING
- N NITROGEN PIPING
- CO CARBON DIOXIDE PIPING
- V V VACUUM VENT PIPING
- WAGD WASTE ANESTHETIC GAS DISPOSAL PIPING
- GV MEDICAL GAS VENT PIPING
- X MEDICAL GAS OUTLET W/ DESIGNATION (RE: BELOW)
  - O OXYGEN
  - N NITROGEN
  - NO NITROUS OXIDE
  - WAGD WASTE ANESTHETIC GAS DISPOSAL
  - CO CARBON DIOXIDE
  - MV MEDICAL VACUUM
  - SA SURGICAL AIR
  - S MEDICAL SLIDE

GENERAL SYMBOLS

- INDICATES CONNECT TO EXISTING
- INDICATES ELEVATION
- XXX EQUIPMENT TAG. REFER TO CONNECTIONS SCHEDULE FOR MECHANICAL CONNECTIONS AND LOAD INFO FOR KITCHEN, SHOP, ETC. EQUIPMENT

MECHANICAL PIPING

- RL REFRIGERANT LIQUID
- RS REFRIGERANT SUCTION
- D DRAIN (CONDENSATE)
- CA COMPRESSED AIR
- CWS CHILLED WATER SUPPLY
- CWR CHILLED WATER RETURN
- C/HWS CHILLED/HOT WATER SUPPLY
- C/HWR CHILLED/HOT WATER RETURN
- HWS HOT WATER SUPPLY
- HWR HOT WATER RETURN
- CTWS COOLING TOWER SUPPLY
- CTWR COOLING TOWER RETURN
- STM STEAM (ANY #'S DENOTE PRESSURE)
- CR CONDENSATE RETURN (#'S DENOTE PRESSURE)
- RV REFRIGERANT VENT
- RD RUPTURE DISK

PLUMBING PIPING

- · DOMESTIC COLD WATER
- ·· DOMESTIC HOT WATER
- ··· RECIRCULATING DOMESTIC HOT WATER
- SAN WASTE ABOVE GRADE OR FLOOR
- – –SAN– – WASTE BELOW GRADE OR FLOOR
- ST STORM ABOVE GRADE OR FLOOR
- – – ST – – STORM BELOW GRADE OR FLOOR
- ST/O STORM OVERFLOW ABOVE GRADE OR FLOOR
- – – ST/O – – STORM OVERFLOW BELOW GRADE OR FLOOR
- V PLUMBING VENT
- W WATER SERVICE
- G GAS (NATURAL)
- PD FROM SUMP PUMP DISCHARGE
- CA COMPRESSED AIR
- LP PROPANE
- SCW SOFT DOMESTIC COLD WATER
- SHW SOFT DOMESTIC HOT WATER
- SRW SOFT RECIRCULATING HOT WATER
- ACID ACID WASTE
- ---VACID--- ACID WASTE VENT
- NP NON-POTABLE
- DI DEIONIZED WATER
- RO REVERSE OSMOSIS WATER
- W&V XX PLUMBING RISER CALLOUT (REFERS TO RISER DIAGRAM)

FIRE SPRINKLER

- F FIRE PROTECTION PIPING
- SPRINKLER HEAD
- SIDEWALL SPRINKLER HEAD
- FIRE PROTECTION SIAMESE CONNECTION
- POST INDICATOR VALVE

PIPING SYMBOLS

- SHUTOFF VALVE
- SHUTOFF VALVE IN RISER
- BALANCING VALVE
- PLUG VALVE
- AUTO FLOW CONTROL VALVE
- PIPING ELBOW UP
- PIPING ELBOW DOWN
- PIPING TEE
- PIPING ELBOW
- PIPING TEE UP
- PIPING TEE DOWN
- INCREASER / REDUCER
- UNION
- CAP
- PIPE FLEX
- STRAINER
- CHECK VALVE
- INLINE STRAINER
- TEST PLUG
- GUIDE
- ANCHOR
- TRIPLE DUTY VALVE
- AUTOMATIC 2-WAY CONTROL VALVE
- AUTOMATIC 3-WAY CONTROL VALVE
- S SOLENOID VALVE

PIPING SPECIALTIES

- P T PRESS/ TEMP GAUGE WITH COCK
- THERMOMETER.
- HI LOW PRESSURE REDUCING VALVE
- RELIEF VALVE
- WATER HAMMER ARRESTER

PLUMBING FIXTURES/EQUIPMENT

- HB HOSE BIBB
- WH WALL HYDRANT
- CLEAN OUT
- RPZ REDUCED PRESSURE BACKFLOW PREVENTER
- DCBP DOUBLE CHECK BACKFLOW PREVENTER
- WC-1 S-1 PLUMBING FIXTURE AND CALLOUT
- FD-1 FD: FLOOR DRAIN, AD: AREA DRAIN, FS: FLOOR SINK
- RD-1 RD: ROOF DRAIN ORD: OVERFLOW ROOF DRAIN

SHEET INDEX

ABBREVIATIONS

A/E	ARCHITECT / ENGINEER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AG	ABOVE GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
ARCH	ARCHITECT
BFP	BACKFLOW PREVENTER
BG	BELOW GRADE
BLDG	BUILDING
BMS	BUILDING MANAGEMENT SYSTEM
C	CONDUIT
CD	CANDELA
CD	COLD DECK
CLG	COOLING
CM	COORDINATE MOUNTING HEIGHT
CO	CLEAN OUT
CTE	CONNECT TO EXISTING
DCVA	DOUBLE CHECK VALVE ASSEMBLY
DCW	DOMESTIC COLD WATER
DDC	DIRECT DIGITAL CONTROLS
DF	DRINKING FOUNTAIN
DHW	DOMESTIC HOT WATER
DHWR	DOMESTIC HOT WATER RETURN
DIA	DIAMETER
DN	DOWN
E/C	ELECTRICAL CONTRACTOR
EA	EXHAUST AIR
EDF	ELECTRIC DRINKING FOUNTAIN
ELEV	ELEVATION
EM	EMERGENCY FIXTURE/DEVICE
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING ITEM
FFA	FROM FLOOR ABOVE
FFB	FROM FLOOR BELOW
FFCO	FINISHED FLOOR CLEAN OUT
FGCO	FLUSH GRADE CLEAN OUT
FL	FLOW LINE
FLR	FLOOR
FP	FIRE PROTECTION
FPM	FEET PER MINUTE
FWCO	FLUSH WALL CLEAN OUT
G	GROUND / GANG
G/C	GENERAL CONTRACTOR
GFI	GROUND FAULT CIRCUIT INTERUPTER
GFIP	GFI-PROTECTED DEVICE
GPM	GALLONS PER MINUTE
HD	HOT DECK
HTG	HEATING
IG	ISOLATED GROUND
JB	JUNCTION BOX
LED	LIGHT EMITTING DIODE
LWT	LEAVING WATER TEMPERATURE
M/C	MECHANICAL CONTRACTOR
MA	MIXED AIR
MAU	MAKE UP AIR UNIT
MCB	MAIN CIRCUIT BREAKER
MECH	MECHANICAL
MH	MANHOLE
MLO	MAIN LUGS ONLY
NFA	NET FREE AREA
NL	NIGHT LIGHT
OA	OUTSIDE AIR
ORD	OVERFLOW ROOF DRAIN
P/C	PLUMBING CONTRACTOR
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYLCHLORIDE
RA	RETURN AIR
RE/REF	REFER / REFERENCE
RF	RELIEF FAN
RL	RELOCATED ITEM
RPZ	REDUCED PRESSURE ZONE
RR	RESTROOM
SA	SUPPLY AIR
SPD	SURGE PROTECTIVE DEVICE
ST	SHUNT TRIP
TA	TRANSFER AIR
TFA	TO FLOOR ABOVE
TFB	TO FLOOR BELOW
TP	TAMPERPROOF
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VRF	VARIABLE REFRIGERANT FLOW
VTR	VENT THROUGH ROOF
WCO	WALL CLEANOUT
WG	WIRE GUARD
WP	WEATHERPROOF

FIRE SEALING NOTES

1. COORDINATE CONSTRUCTION OF OPENINGS AND PENETRATING ITEMS TO ENSURE THAT THROUGH-PENETRATION FIRESTOP SYSTEMS ARE INSTALLED ACCORDING TO SPECIFIED AND APPLICABLE UL REQUIREMENTS.
2. COORDINATE SIZING OF SLEEVES, OPENINGS, CORE-DRILLED HOLES, OR CUT OPENINGS TO ACCOMMODATE THROUGH-PENETRATION FIRESTOP SYSTEMS.
3. DO NOT COVER UP THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATIONS UNTIL EXAMINED BY INSPECTOR, IF REQUIRED BY AUTHORITIES HAVING JURISDICTION.
4. COMPATIBILITY: PROVIDE THROUGH-PENETRATION FIRESTOP SYSTEMS THAT ARE COMPATIBLE WITH ONE ANOTHER; WITH THE SUBSTRATES FORMING OPENINGS; AND WITH THE ITEMS, IF ANY, PENETRATING THROUGH-PENETRATION FIRESTOP SYSTEMS, UNDER CONDITIONS OF SERVICE AND APPLICATION, AS DEMONSTRATED BY THROUGH-PENETRATION FIRESTOP SYSTEM MANUFACTURER BASED ON TESTING AND FIELD EXPERIENCE.
5. PROVIDE COMPONENTS FOR EACH THROUGH-PENETRATION FIRESTOP SYSTEM THAT ARE NEEDED TO INSTALL FILL MATERIALS. USE ONLY COMPONENTS SPECIFIED BY THROUGH-PENETRATION FIRESTOP SYSTEM MANUFACTURER AND APPROVED BY QUALIFIED TESTING AND INSPECTING AGENCY FOR FIRESTOP SYSTEMS INDICATED.
6. PROVIDE SLEEVES THROUGH ALL FIRE-RATED WALLS AND FILL VOIDS SURROUNDING SLEEVES AND INTERIOR TO SLEEVES AROUND PIPING WITH FIRE STOP PUTTY WITH U.L. LISTED 3 HOUR RATING INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
7. FIRE SEAL ALL PIPING, CONDUIT, CABLE, ETC PENETRATIONS ROUTED THROUGH FIRE RATED WALLS.
8. PROVIDE FIRE RATED ENCLOSURES OR WRAPS ON LIGHT FIXTURES AND OTHER ITEMS PENETRATING FIRE RATED CEILINGS, FLOOR/CEILING/ CEILING/ROOF ASSEMBLIES TO MAINTAIN UL LISTING FOR CONSTRUCTION.

GEN. MECHANICAL NOTES

1. COMPLETE INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED VERSION OF THE INTERNATIONAL MECHANICAL CODE, LOCAL AND STATE CODES, AND REQUIREMENTS OF THE AHJ.
2. ANY POWER FOR CONTROL SYSTEMS TO BE PROVIDED BY E/C IS INDICATED ON ELECTRICAL PLANS. ANY ADDITIONAL LINE VOLTAGE OR LOW VOLTAGE POWER REQUIRED BY THE M/C OR SUBCONTRACTORS TO HAVE A FULLY FUNCTIONING SYSTEM SHALL BE PROVIDED BY THE M/C CONTRACTOR OR SUBS.
3. ALL EQUIPMENT SHALL BE ADEQUATELY AND PROPERLY SUPPORTED AND FASTENED FROM STRUCTURE.
4. ALL EQUIPMENT AND ACCESSORIES INSTALLED IN CONCEALED SPACES REQUIRING ACCESS SHALL BE PROVIDED WITH ACCESS DOORS MEETING ANY FIRE REQUIREMENTS OF THE WALL/CEILING THEY ARE INSTALLED.
5. EACH AIR HANDLING UNIT OVER 2000CFM SHALL BE PROVIDED WITH A SMOKE DETECTOR TO SHUT DOWN THE UNIT PER IMC 606 AS REQUIRED BY AHJ. COORDINATE WITH OTHER TRADES.
6. START UP AND ADJUST ALL EQUIPMENT AND VERIFY ALL MECHANICAL SYSTEMS IN OPERATE IN ACCORDANCE WITH THEIR INTENDED PURPOSES. SUBMIT BALANCE AND START UP REPORTS TO THE A/E. REFER TO SPECIFICATIONS FOR ANY ADDITIONAL REQUIREMENTS.

GENERAL PLUMBING NOTES

1. COMPLETE INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED VERSION OF THE INTERNATIONAL PLUMBING CODE, LOCAL AND STATE CODES, AND REQUIREMENTS OF THE AHJ.
2. NO PIPING SHALL BE INSTALLED WHERE IT WILL SUBJECT TO FREEZING TEMPERATURES. PIPING IN EXTERIOR WALLS SHALL BE INSTALLED ON THE WARM SIDE OF BUILDING INSULATION, INSULATED AND THE CHASE SHALL BE VENTILATED WITH GRILLES ALLOWING INDOOR AMBIENT CONDITIONS TO CIRCULATE THROUGH THE CHASE.
3. PROVIDE CLEANOUTS IN THE FOLLOWING LOCATIONS:
   - 3.1. IN ALL HORIZONTAL DRAINS (WITHIN THE BUILDING) NOT MORE THAN 100 FEET APART.
   - 3.2. IN BUILDING SEWERS LOCATED NO MORE THAN 100 FEET APART MEASURED FROM THE UPSTREAM ENTRANCE OF THE CLEANOUT.
   - 3.3. EACH CHANGE OF DIRECTION OF THE BUILDING DRAIN OR HORIZONTAL WASTE OR SOIL LINES GREATER THAN 45 DEGREES. WHERE MORE THAN ONE CHANGE OF DIRECTION OCCURS IN A RUN OF PIPING, ONLY ONE CLEANOUT SHALL BE REQUIRED FOR EACH 40 FEET OF DEVELOPED LENGTH OF THE DRAINAGE PIPING.
   - 3.4. AT THE BASE OF EACH WASTE OR SOIL STACK.
   - 3.5. NEAR THE JUNCTION OF THE BUILDING DRAIN AND BUILDING SEWER.

GENERAL ELECTRICAL NOTES

1. COMPLETE INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED VERSION OF THE NATIONAL ELECTRICAL CODE, LOCAL AND STATE CODES, AND REQUIREMENTS OF THE AHJ.
2. COORDINATE LOCATIONS OF RECEPTACLES, SWITCHES, ETC. WITH ARCHITECTURAL CASEWORK AND ELEVATIONS.
3. REFER TO MOUNTING HEIGHTS DETAIL FOR MOUNTING HEIGHTS OF ALL DEVICES NOT INDICATED OTHERWISE.
4. PROVIDE ALL EMPTY CONDUITS WITH PULL STRINGS AND BUSHED ENDS.
5. CONTRACTOR SHALL CONCEAL ALL CONDUIT, FITTINGS, AND DEVICES FROM VIEW WHERE REASONABLY POSSIBLE.

COORDINATION NOTES

1. COORDINATE REQUIREMENTS FOR INSTALLATION OF SYSTEMS AND EQUIPMENT WITH ALL OTHER TRADES.
2. THE CONTRACTOR SHALL COORDINATE THE ROUTING AND PATH OF ALL SYSTEMS, CONDUITS, PIPES, DUCTS, ETC WITH THE POSITION AND LAYOUT OF THE STRUCTURE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING NECESSARY OFFSETS, TURNS, RISES AND DROPS FOR SYSTEMS AND COMPONENTS AS NEEDED TO INSTALL THE MEP SYSTEMS TO CLEAR STRUCTURE, CEILINGS, ETC AND OTHER SYSTEMS IN POTENTIAL CONFLICT WITH ROUTING.
3. COORDINATE WORK WITH OTHER TRADES TO INSTALL SYSTEMS ABOVE CEILING HEIGHTS INDICATED ON ARCHITECTURAL PLANS.
4. CHECK SPACE REQUIREMENTS WITH OTHER TRADES AND STRUCTURE/CONSTRUCTION TO ENSURE THAT ALL MATERIALS AND EQUIPMENT CAN BE INSTALLED IN THE SPACE ALLOTTED INCLUDING FINISHED SUSPENDED CEILINGS AND OTHER SPACES, CHASES, ETC WITHIN THE BUILDING. MAKE MODIFICATIONS THERETO AS REQUIRED AND APPROVED.
5. TRANSMIT TO OTHER TRADES ALL INFORMATION REQUIRED FOR WORK TO BE PROVIDED UNDER THEIR RESPECTIVE SECTIONS IN AMPLE TIME FOR INSTALLATION.
6. WHEREVER WORK INTERCONNECTS WITH WORK OF OTHER TRADES, COORDINATE WITH THOSE TRADES TO ENSURE THAT ALL SUBCONTRACTORS HAVE THE INFORMATION NECESSARY SO THAT THEY MAY PROPERLY INSTALL ALL CONNECTIONS AND EQUIPMENT. IDENTIFY ALL ITEMS OF WORK THAT REQUIRE ACCESS SO THAT THE CEILING TRADE WILL KNOW WHERE TO INSTALL ACCESS DOORS AND PANELS.
7. COORDINATE, PROJECT AND SCHEDULE WORK WITH OTHER TRADES IN ACCORDANCE WITH THE CONSTRUCTION SEQUENCE.
8. DRAWINGS SHOW THE GENERAL RUNS OF CONDUITS, PIPING AND DUCTWORK AND APPROXIMATE LOCATION OF OUTLETS. ANY SIGNIFICANT CHANGES IN LOCATION OF ITEMS NECESSARY IN ORDER TO MEET FIELD CONDITIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT/ENGINEER AND RECEIVE HIS APPROVAL BEFORE SUCH ALTERATIONS ARE MADE. ALL SUCH MODIFICATIONS SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION AND REPAIR OF SURFACES, AREAS AND PROPERTY THAT MAY BE DAMAGED AS A RESULT OF CONSTRUCTION ACTIVITIES.
10. ADJUST LOCATION OF PIPING, DUCTWORK, ETC. TO PREVENT INTERFERENCES, BOTH ANTICIPATED AND ENCOUNTERED. DETERMINE THE EXACT ROUTE AND LOCATION OF EACH ITEM PRIOR TO FABRICATION. MAKE OFFSETS, TRANSITIONS AND CHANGES IN DIRECTION IN SYSTEMS AS REQUIRED TO MAINTAIN ADEQUATE CLEARANCES AND HEADROOM.
11. WHEREVER THE WORK IS OF SUFFICIENT COMPLEXITY, PREPARE ADDITIONAL COORDINATION DRAWINGS AND ORGANIZE ON-SITE MEETINGS WITH ALL RELATED SUBCONTRACTORS TO COORDINATE THE WORK BETWEEN TRADES . DRAWINGS SHALL CLEARLY SHOW THE WORK AND ITS RELATION TO THE WORK OF OTHER TRADES, AND BE SUBMITTED FOR REVIEW PRIOR TO COMMENCING SHOP FABRICATION OR ERECTION IN THE FIELD.
12. COORDINATE WITH LOCAL UTILITY PROVIDERS FOR THEIR REQUIREMENTS FOR SERVICE CONNECTIONS AND PROVIDE ALL NECESSARY PAYMENTS, MATERIALS, LABOR AND TESTING TO ACCOMPLISH THE WORK.
13. COORDINATE THE MOUNTING OF SUSPENDED LIGHT FIXTURES UTILIZING INDIRECT LIGHT SO THAT CONDUIT, DUCTWORK, STRUCTURAL MEMBERS, ETC. ARE NOT LOCATED DIRECTLY ABOVE THE LIGHT FIXTURE. MAINTAIN A MINIMUM OF 24" CLEARANCE FROM THESE ITEMS WHENEVER POSSIBLE.

DEMOLITION NOTES

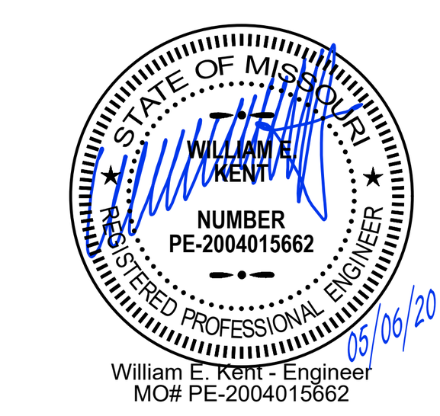
1. ALL WORK SHOWN DARK AND DASHED IS TO BE DEMOLISHED. WORK SHOWN LIGHT IS EXISTING TO REMAIN.
2. REFER TO ARCHITECTURAL PLANS FOR FURTHER EXTENT OF DEMOLITION REQUIREMENTS.
3. ALL EXISTING PIPING SCHEDULED FOR DEMOLITION THAT ROUTES BELOW SLAB SHALL BE GROUND FLUSH WITH FLOOR, PLUGGED AND THE FLOOR PATCHED TO MATCH SURROUNDING FLOOR.
4. COORDINATE ALL DEMOLITION WORK WITH OWNER.
5. CONTACT UTILITY LOCATING SERVICE TO LOCATE EXACT LOCATION OF UTILITIES BELOW GRADE.
6. MAINTAIN ALL EXISTING DEVICES, EQUIPMENT, ASSOCIATED CIRCUITS ETC, SHOWN AS EXISTING TO REMAIN OR OTHERWISE UNRELATED TO THE SCOPE OF THE PROJECT IN WORKING ORDER.
7. CONTRACTOR SHALL REMOVE LAY-IN CEILINGS, LIGHT FIXTURES, ETC. AS REQUIRED FOR CONSTRUCTION WHERE NEEDED PRIOR TO DEMOLITION AND REPLACE SAME AFTER CONSTRUCTION. EXISTING CONDUITS ABOVE CEILINGS SHALL BE RELOCATED AND/OR TEMPORARILY REMOVED TO FACILITATE THE INSTALLATION OF NEW EQUIPMENT.
8. THE OWNER SHALL REMOVE ALL ITEMS THEY DESIRED TO SALVAGE PRIOR TO CONSTRUCTION BEGINNING.
9. NOTES AND DRAWINGS ARE BASED UPON A FIELD EXAMINATION OF THE SITE AND MAY NOT INDICATE ALL ITEMS. THE CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE SITE AND THE SCOPE OF WORK FOR THE CONTRACT PRIOR TO BID. ANY EXISTING CONDITION WHICH IS APPARENT OR COULD BE REASONABLY INFERRED FROM A VISIT TO THE SITE SHALL NOT BE THE BASIS FOR A CHANGE IN THE CONTRACT AMOUNT.
10. REFER TO NEW WORK PLANS FOR ANY ITEMS THAT MAY REQUIRE RELOCATION AFTER DEMOLITION.
11. PROPERLY DISPOSE OF ALL DEMOLISHED ITEMS OFF SITE.
12. REMOVE ALL MISCELLANEOUS CONDUITS, PIPES, ETC, THOUGH NOT SPECIFICALLY SHOWN ON PLAN, THAT ARE EITHER UNUSED OR WILL BECOME UNUSED DUE DEMOLITION ACTIVITIES, IN ORDER TO PROVIDE A "CLEAN" SPACE FOR THE OWNER.
13. PROTECT ALL EXISTING SURFACES AND EQUIPMENT DURING CONSTRUCTION. EXISTING ITEMS TO REMAIN SHALL BE ADEQUATELY PROTECTED FROM DEMOLITION AND NEW CONSTRUCTION WORK, AS REQUIRED. ANY ITEMS DAMAGED OR MARRED SHALL BE ADEQUATELY CLEANED OR REPLACED TO THE OWNERS SATISFACTION TO ORIGINAL CONDITION BEFORE CONSTRUCTION.
14. PATCH ANY HOLES IN STRUCTURE CREATED BY REMOVAL OF DUCTWORK, CONDUITS, PIPES, ETC.
15. REMOVE ALL ITEMS SHOWN IN WALLS TO BE DEMOLISHED. ALL ELECTRICAL CONDUIT AND WIRING SHALL BE REMOVED BACK TO PANELBOARDS AND PROPERLY TERMINATED.
16. SAW CUT FLOOR FOR THE INSTALLATION OF NEW SANITARY PIPING. REFER TO PLUMBING PLANS SHOWING NEW WORK.
17. SAVE, CLEAN, AND RE-LAMP ALL LIGHT FIXTURES NOTED AS BEING RELOCATED. REFER TO NEW WORK PLANS AND LIGHT FIXTURE SCHEDULE FOR DESCRIPTIONS, QUANTITIES, AND LOCATIONS OF FIXTURES TO BE RE-USED.

GENERAL NOTES

1. SOME ROOM NAMES MAY NOT BE SHOWN FOR PURPOSE OF CLARIFYING PLAN. REFER TO ARCHITECTURAL PLANS FOR REFERENCE TO ROOM NAMES NOT SHOWN.
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN AND KEEP AT THE JOB SITE, AN UP TO DATE SET OF "RECORD DRAWINGS" SHOWING ALL CHANGES FROM THE ORIGINAL PLANS. THE CONTRACTOR SHALL DELIVER THE "RECORD DRAWINGS" TO THE ENGINEER AT THE CONCLUSION OF THE PROJECT ELECTRONICALLY.
3. THESE DRAWINGS ARE DIAGRAMMATIC. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS (NEW AND EXISTING), DIMENSIONS, AND CLEARANCES PRIOR TO THE COMMENCEMENT OF WORK AND SHALL INCLUDE ALL COSTS, EQUIPMENT, MATERIAL, ACCESSORIES, ETC. REQUIRED FOR A FULLY COMPLETE, FUNCTIONAL AND CODE COMPLIANT INSTALLATION.
4. FINAL LOCATIONS OF ALL DEVICES, LIGHT FIXTURES, EQUIPMENT ETC SHALL BE INDICATED ON THE ARCHITECTURAL DRAWINGS. ALL DIMENSIONAL INFORMATION SHALL BE OBTAINED FROM ARCHITECTURAL PLANS. NO DIMENSIONAL INFORMATION SHALL BE OBTAINED FROM MEP DRAWINGS.
5. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS, APPROVALS, LICENSES, ETC. AS NEEDED FOR THE COMPLETE INSTALLATION AND PROJECT. THE CONTRACTOR SHALL COORDINATE WITH THE OWNER FOR ALL FEES AND DATA NEEDED FOR THIS.

GEN. RENOVATION NOTES

1. DISCONNECT AND REMOVE ANY EQUIPMENT, PIPING OR DUCTWORK THAT WAS INSTALLED AS PART OF THE BUILDING SHELL THAT IS NOT NEEDED OR CONFLICTS WITH THIS BUILD OUT.
2. EXISTING UNDERGROUND PIPING LOCATIONS ARE ESTIMATED BASED UPON ANTICIPATED ROUTINGS. FIELD VERIFY EXACT LOCATIONS DURING CONSTRUCTION AND PROVIDE ALL NECESSARY MODIFICATIONS.
3. SAWCUT GRADE FLOOR SLABS TO INSTALL NEW PIPING, MECHANICAL SYSTEMS, ELECTRICAL FLOOR BOXES AND ALL ASSOCIATED CONDUIT, ETC. PATCH FLOOR TO MAKE LIKE NEW AFTER INSTALLATION. TAKE CARE TO LOCATE EXISTING CONDUIT, ETC AND AVOID CUTTING EXISTING CONDUITS BY NOT OVER-CUTTING SLAB DEPTH.
4. SAWCUT AND CORE DRILL OPENINGS AS REQUIRED FOR ABOVE GRADE SLAB PENETRATIONS. X-RAY SLABS TO ASCERTAIN STEEL AND EXISTING CONDUIT PENETRATIONS PRIOR TO CUTTING. VERIFY OPENINGS WITH STRUCTURAL ENGINEER PRIOR TO CUTTING.
5. HOMERUN CIRCUITS TO 20 AMP, SINGLE POLE BREAKERS IN PANELBOARDS INDICATED. UTILIZE SPARE BREAKERS MADE AVAILABLE BY DEMOLITION, IF NO SPARE BREAKER IS AVAILABLE, PROVIDE NEW BREAKER.
6. EXISTING CIRCUITING MAY BE RE-USED WHERE POSSIBLE.
7. CONCEAL NEW CIRCUITING IN WALLS WHERE POSSIBLE. FOR NEW DEVICES INSTALLED ON EXISTING SOLID WALLS, CONCEAL CIRCUITING IN WIREMOLD. COORDINATE FINISH AND GENERAL ROUTING OF WIREMOLD WITH ARCHITECT TO BE AS CONCEALED AND/OR ROUTED IN A NEAT AND ORGANIZED CONSISTENT MANNER.
8. ALL LIGHTING FIXTURES THAT ARE RELOCATED OR OTHERWISE AFFECTED BY THE SCOPE OF WORK SHALL BE CLEANED AND RELAMPED.



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KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS

KANSAS CITY, KANSAS

ISSUED FOR:

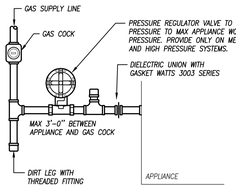
	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY:	KJ
CHECKED BY:	WK

SHEET TITLE: COVER SHEET

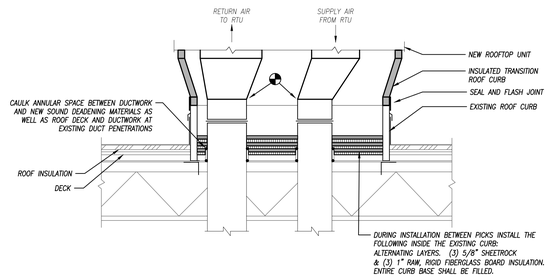
DATE: 05/06/20 PKMR PROJECT: 19.130

SHEET NUMBER: ME0



TYPICAL GAS CONNECTION

NOT TO SCALE



ROOFTOP UNIT TRANSITION CURB DETAIL

NOT TO SCALE

GENERAL HVAC NOTES

1. *REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.*
2. *ROUND BRANCH DUCT RUNOUTS AND FLEXIBLE DUCT SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.*
3. *MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0".*
4. *ALL RUNOUTS TO TERMINAL BOXES SHALL BE ONE SIZE LARGER THAN BOX INLETS UNLESS NOTED OTHERWISE.*
5. *ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.*
6. *ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.*
7. *DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.*
8. *PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.*
9. *FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.*

PLAN KEYED NOTES

1 *DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.*

2 *CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.*

ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA			COOLING COIL			GAS HEATING			FILTERS			ELECTRICAL			NOTES
					E.S.P.	BHP	HP	EAT (DB/WB)	LAT (DB/WB)	T/S CAPACITY	INPUT (MBH)	OUTPUT (MBH)	EAT/LAT (°F)	NO.	THICKNESS	SIZE	VOLTAGE/PHASE	MCA	MOCP	
RTU-1	YORK	ZJ049S	1,600	230	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	120.0	96.0	60 / 115	4	2"	24x16	480V / 3PH	11.7	15	1,2,3,4,5,6,7
RTU-2	YORK	ZJ150S	5,000	1,090	1.00	4.62	5	84 / 69	57 / 55	142.3 / 123.4	250.0	203.0	60 / 100	4	2"	24x20	480V / 3PH	37.2	45	1,2,3,4,5,6,7
RTU-3	YORK	ZJ180S	6,000	985	1.00	4.10	5	84 / 69	57 / 55	166.3 / 133.1	350.0	284.0	60 / 105	12	2"	12x24	480V / 3PH	42.6	45	1,2,3,4,5,6,7
RTU-4	YORK	ZJ150S	5,000	1,165	1.00	4.62	5	84 / 69	57 / 55	142.3 / 123.4	250.0	203.0	60 / 100	4	2"	24x20	480V / 3PH	37.2	45	1,2,3,4,5,6,7
RTU-5	YORK	ZJ210S	7,000	1,185	1.00	5.44	7 1/2	84 / 69	57 / 55	190.4 / 151.9	350.0	284.0	60 / 100	12	2"	12x24	480V / 3PH	47.4	50	1,2,3,4,5,6,7
RTU-6	YORK	ZJ102S	3,400	300	1.00	2.19	3	84 / 69	57 / 55	110.9 / 106.3	250.0	203.0	60 / 115	4	2"	24x20	480V / 3PH	20.8	25	1,2,3,4,5,6,7
RTU-7	YORK	ZJ061S	1,600	400	1.00	0.85	1 1/2	84 / 69	57 / 55	52.8 / 37.5	135.0	109.0	60 / 120	4	2"	24x16	480V / 3PH	14.0	20	1,2,3,4,5,6,7
RTU-8	YORK	ZJ049S	1,600	400	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	120.0	96.0	60 / 115	4	2"	24x16	480V / 3PH	11.7	15	1,2,3,4,5,6,7

REMARKS:

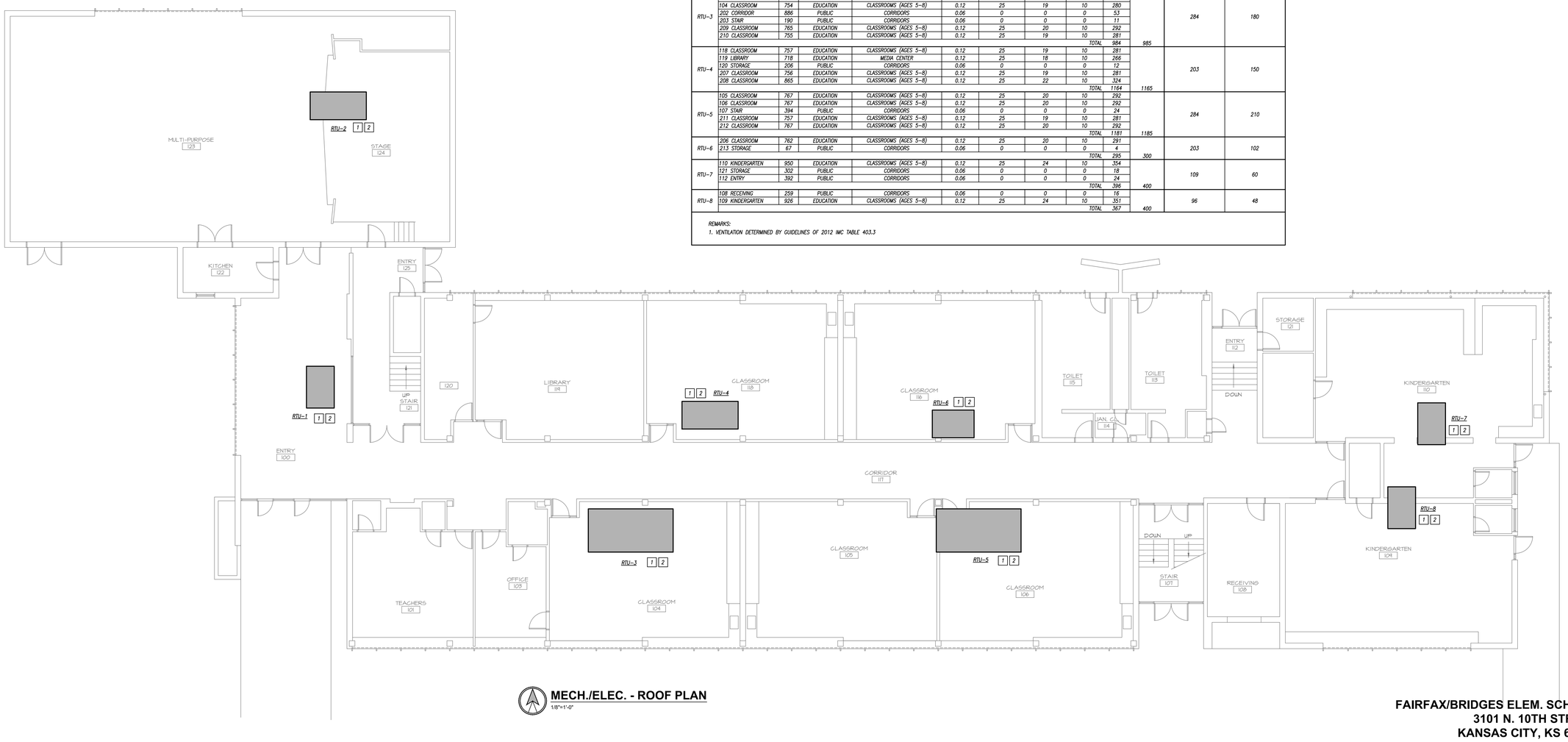
1. *COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.*
2. *FURNISH WITH INTEGRAL SINGLE-POINT ELECTRICAL DISCONNECT.*
3. *FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.*
4. *FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.*
5. *REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.*
6. *FURNISH WITH ECONOMIZER WITH POWERED RELIEF.*
7. *FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.*

OUTSIDE AIR / HVAC LOAD SCHEDULE

UNIT	# NAME	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	100 ENTRY	963	OFFICES	RECEPTION AREAS	0.06	30	29	5	203		96	48
	121 STAIR	96	PUBLIC	CORRIDORS	0.06	0	0	0	6			
	125 ENTRY	282	PUBLIC	CORRIDORS	0.06	0	0	0	17			
								TOTAL	225	230		
RTU-2	123 MULTIPURPOSE	2253	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	16	20	726		203	150
	124 STAGE	867	EDUCATION	MUSIC/THEATER/DANCE	0.06	35	31	10	362			
								TOTAL	1088	1090		
RTU-3	101 TEACHERS	427	OFFICES	OFFICE SPACES	0.06	5	3	5	41		284	180
	103 OFFICE	271	OFFICES	OFFICE SPACES	0.06	5	2	5	26			
	104 CLASSROOM	754	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	280			
	202 CORRIDOR	886	PUBLIC	CORRIDORS	0.06	0	0	0	53			
	203 STAIR	190	PUBLIC	CORRIDORS	0.06	0	0	0	11			
	209 CLASSROOM	765	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	292			
	210 CLASSROOM	755	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281			
								TOTAL	984	985		
RTU-4	118 CLASSROOM	757	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281		203	150
	119 LIBRARY	718	EDUCATION	MEDIA CENTER	0.12	25	18	10	266			
	120 STORAGE	206	PUBLIC	CORRIDORS	0.06	0	0	0	12			
	207 CLASSROOM	756	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281			
	208 CLASSROOM	865	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	22	10	324			
								TOTAL	1164	1165		
RTU-5	105 CLASSROOM	767	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	292		284	210
	106 CLASSROOM	767	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	292			
	107 STAIR	394	PUBLIC	CORRIDORS	0.06	0	0	0	24			
	211 CLASSROOM	757	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281			
	212 CLASSROOM	767	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	292			
								TOTAL	1181	1185		
RTU-6	206 CLASSROOM	762	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	291		203	102
	213 STORAGE	67	PUBLIC	CORRIDORS	0.06	0	0	0	4			
								TOTAL	295	300		
RTU-7	110 KINDERGARTEN	950	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	24	10	354		109	60
	121 STORAGE	302	PUBLIC	CORRIDORS	0.06	0	0	0	18			
	112 ENTRY	392	PUBLIC	CORRIDORS	0.06	0	0	0	24			
								TOTAL	396	400		
RTU-8	108 RECEIVING	259	PUBLIC	CORRIDORS	0.06	0	0	0	16		96	48
	109 KINDERGARTEN	926	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	24	10	351			
								TOTAL	367	400		

REMARKS:

1. *VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3*



MECH./ELEC. - ROOF PLAN

1/8"=1'-0"

FAIRFAX/BRIDGES ELEM. SCHOOL
3101 N. 10TH STREET
KANSAS CITY, KS 66104

STATE OF MISSOURI
WILLIAM E. KNEN
NUMBER PE-2004015662
PROFESSIONAL ENGINEER
05/06/20
William E. Knen, Engineer
MO# PE-2004015662

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
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913.492.2400 WWW.PKMRENG.COM

KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS

KANSAS CITY, KANSAS

ISSUED FOR:

	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY:	KJ
CHECKED BY:	WK

SHEET TITLE: MECH / ELEC ROOF PLAN

DATE: 05/06/20 PKMR PROJECT: 19.130

SHEET NUMBER: ME1

MECH./ELEC. - ROOF PLAN

1/8"=1'-0"

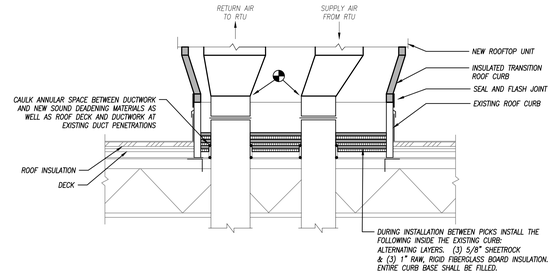
GENERAL HVAC NOTES

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. ROUND BRANCH DUCT RUNOUTS AND FLEXIBLE DUCT SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.
3. MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0".
4. ALL RUNOUTS TO TERMINAL BOXES SHALL BE ONE SIZE LARGER THAN BOX INLETS UNLESS NOTED OTHERWISE.
5. ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.
6. ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.
7. DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.
8. PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.
9. FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.

HVAC PLAN KEYED NOTES

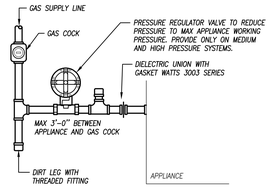
1 DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.

2 CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.



ROOFTOP UNIT TRANSITION CURB DETAIL

NOT TO SCALE



TYPICAL GAS CONNECTION

NOT TO SCALE

ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA			COOLING COIL			GAS HEATING			FILTERS			ELECTRICAL			NOTES
					E.S.P.	BHP	HP	EAT (DB/WB)	LAT (DB/WB)	T/S CAPACITY	INPUT (MBH)	OUTPUT (MBH)	EAT/LAT (°F)	NO.	THICKNESS	SIZE	VOLTAGE/PHASE	MCA	MOCP	
RTU-1	YORK	ZJ037S	1,200	85	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-2	YORK	ZJ102S	3,400	850	1.00	2.19	3	84 / 69	57 / 55	110.9 / 106.3	135.0	109.0	60 / 90	4	2"	24x20	480V / 3PH	20.8	25	1,2,3,4,5,6,7
RTU-3	YORK	ZJ049S	1,600	400	1.00	0.85	1 1/2	84 / 69	57 / 55	47.5 / 43.2	120.0	96.0	60 / 115	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7
RTU-4	YORK	ZJ037S	1,200	85	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	40.0	32.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-5	YORK	ZR150S	5,000	1,250	1.00	4.49	5	84 / 69	57 / 55	142.3 / 123.4	150.0	122.0	60 / 85	4	2"	24x20	208V / 3PH	70.0	90	1,2,3,4,5,6,7,8
RTU-6	YORK	ZJ078S	2,500	565	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 95	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-7	YORK	ZJ078S	2,500	565	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 95	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-8	YORK	ZJ102S	3,400	850	1.00	2.19	3	84 / 69	57 / 55	110.9 / 106.3	135.0	109.0	60 / 90	4	2"	24x20	480V / 3PH	20.8	25	1,2,3,4,5,6,7
RTU-9	YORK	ZJ102S	3,400	850	1.00	2.19	3	84 / 69	57 / 55	110.9 / 106.3	135.0	109.0	60 / 90	4	2"	24x20	480V / 3PH	20.8	25	1,2,3,4,5,6,7
RTU-10	YORK	ZJ102S	3,400	850	1.00	2.19	3	84 / 69	57 / 55	110.9 / 106.3	135.0	109.0	60 / 90	4	2"	24x20	480V / 3PH	20.8	25	1,2,3,4,5,6,7
RTU-11	YORK	ZJ078S	2,500	565	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 95	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-12	YORK	ZJ078S	2,500	565	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 95	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7

REMARKS:
1. COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.
2. FURNISH WITH INTEGRAL SINGLE-POINT ELECTRICAL DISCONNECT.
3. FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.
4. FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.
5. REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.
6. FURNISH WITH ECONOMIZER WITH POWERED RELIEF.
7. FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.
8. FURNISH WITH HOT GAS REHEAT.

OUTSIDE AIR / HVAC LOAD SCHEDULE

UNIT	NAME #	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	LIBRARY 001	800	EDUCATION	MEDIA CENTER	0.12	25	20	10	296		64	36
								TOTAL	296	300		
RTU-2	KINDERGARTEN 011	1125	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	29	10	425		109	102
	KINDERGARTEN 012	1125	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	29	10	425			
								TOTAL	850	850		
RTU-3	KINDERGARTEN 013	1060	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	27	10	397		96	48
								TOTAL	397	400		
RTU-4	ADMIN SEC. 015	1065	OFFICES	OFFICE SPACES	0.06	5	6	5	94		32	24
								TOTAL	94	100		
RTU-5	MULTI-PURPOSE 005	2855	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	20	20	914		122	150
	STAGE 006	780	EDUCATION	MUSIC/THEATER/DANCE	0.06	35	28	10	327			
								TOTAL	1241	1245		
RTU-6	CLASSROOM 124	823	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	309		97	75
	CLASSROOM 126	823	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	309			
								TOTAL	618	620		
RTU-7	CLASSROOM 122	813	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	308		97	75
	CLASSROOM 123	836	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310			
								TOTAL	618	620		
RTU-8	CLASSROOM 106	760	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281		109	102
	CLASSROOM 107	760	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	281			
	CLASSROOM 108	746	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	280			
								TOTAL	842	845		
RTU-9	CLASSROOM 110	863	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	22	10	324		109	102
	CLASSROOM 112	835	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310			
								TOTAL	634	635		
RTU-10	CLASSROOM 117	795	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	295		109	102
	CLASSROOM 118	729	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	277			
	CLASSROOM 119	729	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	277			
								TOTAL	850	850		
RTU-11	CLASSROOM 105	830	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310		97	75
	CLASSROOM 113	833	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310			
								TOTAL	620	620		
RTU-12	CLASSROOM 114	835	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310		97	75
	CLASSROOM 115	833	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	310			
								TOTAL	620	620		

REMARKS:
1. VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3

DOUGLAS ELEM. SCHOOL
1310 N. 9TH STREET
KANSAS CITY, KS 66101

STATE OF MISSOURI
WILLIAM E. KENT
NUMBER PE-2004015662
PROFESSIONAL ENGINEER
05/06/20
William E. Kent - Engineer
MO# PE-2004015662

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
13300 W 98TH STREET LENEXA, KS 66215
913.492.2400 WWW.PKMRENG.COM

KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS

KANSAS CITY, KANSAS

ISSUED FOR:

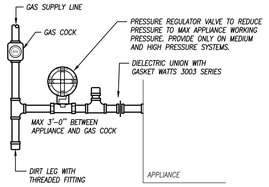
	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY: KJ
CHECKED BY: WK

SHEET TITLE:
MECH/ELEC ROOF PLAN

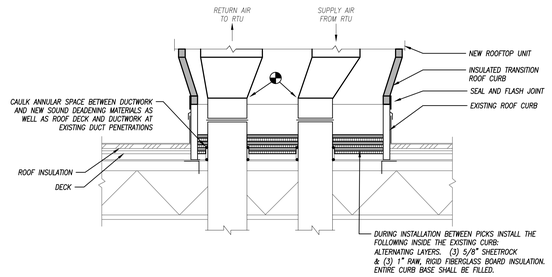
DATE: 05/06/20
PKMR PROJECT: 19.130

SHEET NUMBER:
ME2



TYPICAL GAS CONNECTION

NOT TO SCALE



ROOFTOP UNIT TRANSITION CURB DETAIL

NOT TO SCALE

OUTSIDE AIR / HVAC LOAD SCHEDULE

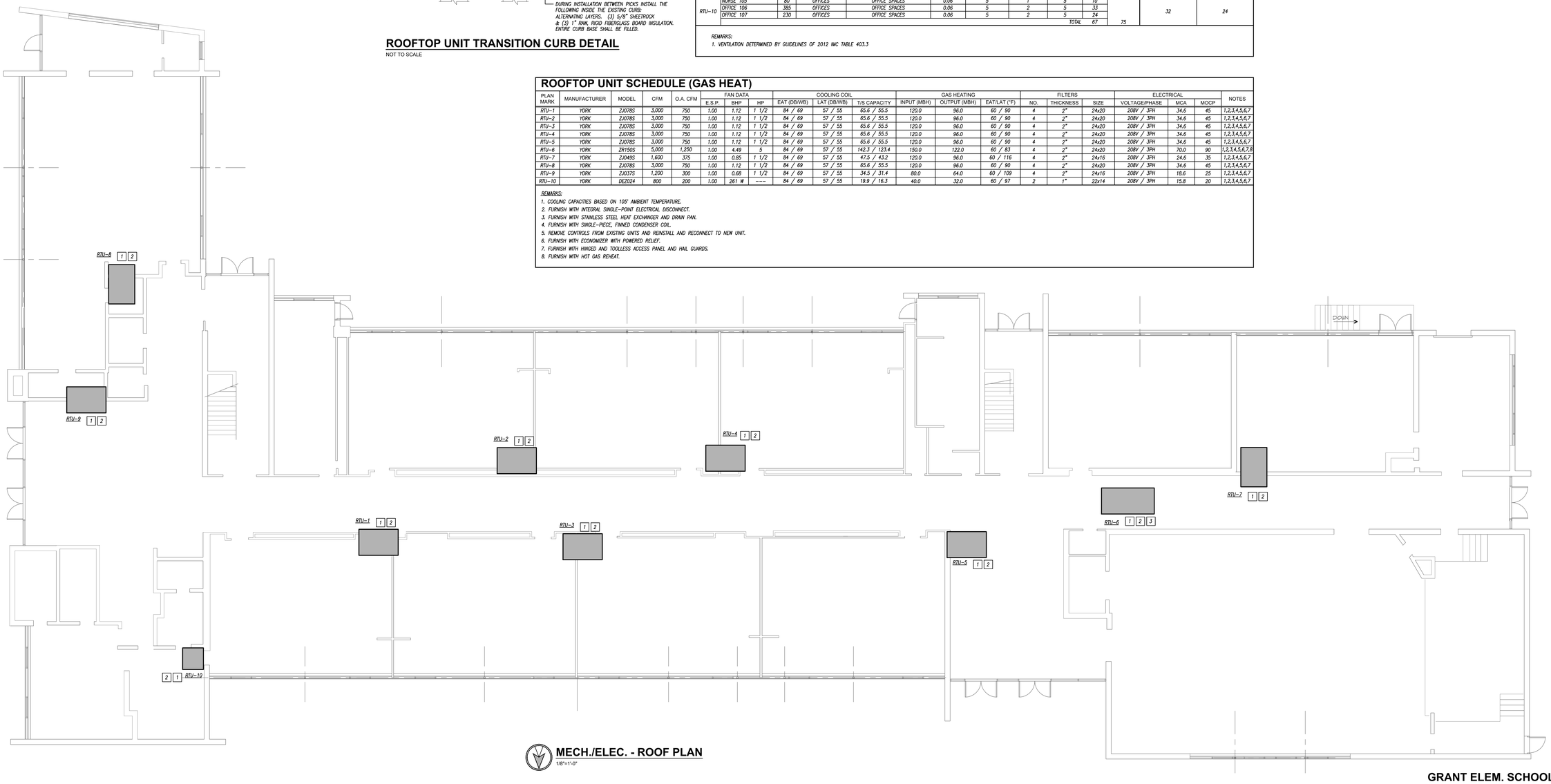
UNIT	# NAME	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	CLASSROOM 118	650	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	248		97	90
	CLASSROOM 120	665	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250			
	CLASSROOM 209	678	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	251			
								TOTAL	749	750		
RTU-2	CLASSROOM 117	678	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	251		97	90
	CLASSROOM 121	665	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250			
	CLASSROOM 207	655	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	249			
								TOTAL	750	750		
RTU-3	CLASSROOM 122	670	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250		97	90
	CLASSROOM 210	670	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250			
	CLASSROOM 211	670	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250			
								TOTAL	751	750		
RTU-4	CLASSROOM 123	665	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	250		97	90
	CLASSROOM 205	655	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	249			
	CLASSROOM 206	655	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	249			
								TOTAL	747	750		
RTU-5	CLASSROOM 124	675	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	17	10	251		97	90
	CLASSROOM 212	684	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	18	10	262			
	CLASSROOM 213	602	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	16	10	232			
								TOTAL	745	750		
RTU-6	MULTI-PURPOSE 135	2445	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	18	20	800		122	150
	STAGE 134	770	EDUCATION	MUSIC/THEATER/DANCE	0.06	35	27	10	316			
								TOTAL	1116	1120		
RTU-7	CLASSROOM 130	843	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	22	10	321		96	48
	BOILER ROOM 131	821	PUBLIC	CORRIDORS	0.06	0	0	0	49			
	RECEIVING 132	420	PUBLIC	CORRIDORS	0.06	0	0	0	25			
								TOTAL	396	400		
RTU-8	KINDERGARTEN 112	1498	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	38	10	560		97	75
	COAT ROOM 113	205	PUBLIC	CORRIDORS	0.06	0	0	0	12			
								TOTAL	572	575		
RTU-9	ENTRY 100	1325	OFFICES	MAIN ENTRY LOBBIES	0.06	10	14	5	150		64	36
								TOTAL	150	150		
RTU-10	NURSE 105	80	OFFICES	OFFICE SPACES	0.06	5	1	5	10		32	24
	OFFICE 106	385	OFFICES	OFFICE SPACES	0.06	5	2	5	33			
	OFFICE 107	230	OFFICES	OFFICE SPACES	0.06	5	2	5	24			
								TOTAL	67	75		

REMARKS:
1. VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3

ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA			COOLING COIL			GAS HEATING			FILTERS			ELECTRICAL			NOTES
					E.S.P.	BHP	HP	EAT (DB/WB)	LAT (DB/WB)	T/S CAPACITY	INPUT (MBH)	OUTPUT (MBH)	EAT/LAT (°F)	NO.	THICKNESS	SIZE	VOLTAGE/PHASE	MCA	MOCP	
RTU-1	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-2	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-3	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-4	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-5	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-6	YORK	ZR150S	5,000	1,250	1.00	4.49	5	84 / 69	57 / 55	142.3 / 123.4	150.0	122.0	60 / 83	4	2"	24x20	208V / 3PH	70.0	90	1,2,3,4,5,6,7,8
RTU-7	YORK	ZJ049S	1,600	375	1.00	0.85	1 1/2	84 / 69	57 / 55	47.5 / 43.2	120.0	96.0	60 / 116	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7
RTU-8	YORK	ZJ078S	3,000	750	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 90	4	2"	24x20	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-9	YORK	ZJ037S	1,200	300	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-10	YORK	DEZ024	800	200	1.00	261 W	----	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7

REMARKS:
1. COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.
2. FURNISH WITH INTEGRAL SINGLE-POINT ELECTRICAL DISCONNECT.
3. FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.
4. FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.
5. REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.
6. FURNISH WITH ECONOMIZER WITH POWERED RELIEF.
7. FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.
8. FURNISH WITH HOT GAS REHEAT.



MECH./ELEC. - ROOF PLAN

1/8"=1'-0"

GENERAL HVAC NOTES

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. ROUND BRANCH DUCT RUNOUTS AND FLEXIBLE DUCT SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.
3. MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0".
4. ALL RUNOUTS TO TERMINAL BOXES SHALL BE ONE SIZE LARGER THAN BOX INLETS UNLESS NOTED OTHERWISE.
5. ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.
6. ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.
7. DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.
8. PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.
9. FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.

HVAC PLAN KEYED NOTES

1 DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.

2 CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.

3 PROVIDE SIDE DISCHARGE UNIT TO MATCH EXISTING CONFIGURATION.

STATE OF MISSOURI
WILLIAM E. KENT
NUMBER PE-2004015662
PROFESSIONAL ENGINEER
05/06/20
William E. Kent - Engineer
MO# PE-2004015662

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
13300 W 98TH STREET LENEXA, KS 66215
913.492.2400 WWW.PKMRENG.COM

KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS
KANSAS CITY, KANSAS

ISSUED FOR:

	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY:	KJ
CHECKED BY:	WK

SHEET TITLE: MECH/ELEC ROOF PLAN

DATE: 05/06/20 PKMR PROJECT: 19.130

SHEET NUMBER: ME3

GRANT ELEM. SCHOOL
1510 N 4TH STREET
KANSAS CITY, KS 66101

MECH./ELEC. - ROOF PLAN
1/8"=1'-0"

GENERAL HVAC NOTES

1. *REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.*
2. *ROUND BRANCH DUCT RUNOUTS AND FLEXIBLE DUCT SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.*
3. *MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0".*
4. *ALL RUNOUTS TO TERMINAL BOXES SHALL BE ONE SIZE LARGER THAN BOX INLETS UNLESS NOTED OTHERWISE.*
5. *ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.*
6. *ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.*
7. *DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.*
8. *PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.*
9. *FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.*

HVAC PLAN KEYED NOTES

1 *DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.*

2 *CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.*

3 *PROVIDE SIDE DISCHARGE UNIT TO MATCH EXISTING CONFIGURATION.*

STATE OF MISSOURI
WILLIAM E. KENT
NUMBER PE-2004015662
REGISTERED PROFESSIONAL ENGINEER
05/06/20
William E. Kent - Engineer
MO# PE-2004015662

pkmr ENGINEERS
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KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS
KANSAS CITY, KANSAS

ISSUED FOR:

	DESCRIPTION	DATE
1		
2		
3		

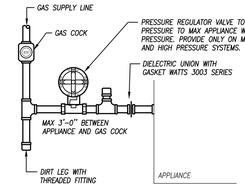
DRAWN BY:	KJ
CHECKED BY:	WK

SHEET TITLE: MECH/ELEC ROOF PLAN

DATE: 05/06/20 PKMR PROJECT: 19.130

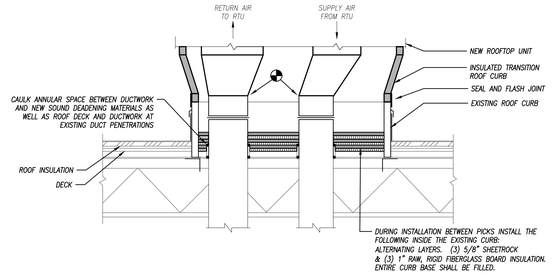
SHEET NUMBER: ME4

LINDBERGH ELEMENTARY SCHOOL
541 N. 57TH STREET
KANSAS CITY, KS 66102



TYPICAL GAS CONNECTION

NOT TO SCALE



ROOFTOP UNIT TRANSITION CURB DETAIL

NOT TO SCALE

OUTSIDE AIR / HVAC LOAD SCHEDULE

UNIT	# NAME	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	CLASSROOM 113	840	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	311		97	75
	CLASSROOM 114	840	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	21	10	311			
								TOTAL	622	625		
RTU-2	CLASSROOM 106	800	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	296		109	120
	CLASSROOM 107	735	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	278			
	CLASSROOM 110	790	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	20	10	295			
								TOTAL	869	870		
RTU-3	CLASSROOM 118	550	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	14	10	206		64	36
								TOTAL	206	300		
RTU-4	CLASSROOM 120	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		32	24
								TOTAL	192	200		
RTU-5	CLASSROOM 122	550	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	14	10	206		64	36
								TOTAL	206	300		
RTU-6	CLASSROOM 121	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		32	24
								TOTAL	192	200		
RTU-7	MULTI-PURPOSE 129	5329	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	38	20	1719		203	210
								TOTAL	1719	1750		
RTU-8	CLASSROOM 131	550	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	14	10	206		64	36
								TOTAL	206	300		
RTU-9	CLASSROOM 132	550	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	14	10	206		64	36
								TOTAL	206	300		
RTU-10	CLASSROOM 133	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		32	24
								TOTAL	192	200		
RTU-11	CLASSROOM 134	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		32	24
								TOTAL	192	200		
RTU-12	CLASSROOM 135	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		32	24
								TOTAL	192	200		
RTU-13	CORRIDOR 119	1360	PUBLIC	CORRIDORS	0.06	0	0	0	82		64	36
								TOTAL	82	85		
RTU-14	OFFICE 101	320	OFFICES	OFFICE SPACES	0.06	5	2	5	29		32	24
	OFFICE 103	184	OFFICES	OFFICE SPACES	0.06	5	1	5	16			
	OFFICE 104	190	OFFICES	OFFICE SPACES	0.06	5	1	5	16			
								TOTAL	62	65		

REMARKS:
1. VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3

ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA E.S.P.	FAN DATA BHP	FAN DATA HP	COOLING COIL EAT (DB/WB)	COOLING COIL LAT (DB/WB)	COOLING COIL T/S CAPACITY	GAS HEATING INPUT (MBH)	GAS HEATING OUTPUT (MBH)	GAS HEATING EAT/LAT (°F)	FILTERS NO.	FILTERS THICKNESS	FILTERS SIZE	ELECTRICAL VOLTAGE/PHASE	ELECTRICAL MCA	ELECTRICAL MOCP	NOTES
RTU-1	YORK	ZJ078S	2,500	625	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 96	2	2"	20x30	208V / 3PH	34.6	45	1,2,3,4,5,6,7
RTU-2	YORK	ZR120S	4,000	870	1.00	2.82	3	84 / 69	57 / 55	112.6 / 95.2	135.0	109.0	60 / 85	4	2"	24x20	208V / 3PH	48.9	60	1,2,3,4,5,6,7,8
RTU-3	YORK	ZJ037S	1,200	300	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-4	YORK	DEZ024	800	200	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7
RTU-5	YORK	ZJ037S	1,200	300	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-6	YORK	DEZ024	800	200	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7
RTU-7	YORK	ZR210S	7,000	1,750	1.00	4.92	5	84 / 69	57 / 55	190.4 / 151.9	250.0	203.0	60 / 87	12	2"	12x24	208V / 3PH	83.5	90	1,2,3,4,5,6,7,8
RTU-8	YORK	ZJ037S	1,200	300	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-9	YORK	ZJ037S	1,200	300	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-10	YORK	DEZ024	800	200	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7
RTU-11	YORK	DEZ024	800	200	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7
RTU-12	YORK	DEZ024	800	200	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7
RTU-13	YORK	ZJ037S	1,200	85	1.00	0.68	1 1/2	84 / 69	57 / 55	34.5 / 31.4	80.0	64.0	60 / 109	4	2"	24x16	208V / 3PH	18.6	25	1,2,3,4,5,6,7
RTU-14	YORK	DEZ024	800	65	1.00	261 W	---	84 / 69	57 / 55	19.9 / 16.3	40.0	32.0	60 / 97	2	1"	22x14	208V / 3PH	15.8	20	1,2,3,4,5,6,7

REMARKS:
1. COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.
2. FURNISH WITH INTEGRAL SINGLE-POINT ELECTRICAL DISCONNECT.
3. FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.
4. FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.
5. REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.
6. FURNISH WITH ECONOMIZER WITH POWERED RELIEF.
7. FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.
8. FURNISH WITH HOT GAS REHEAT.

LINDBERGH ELEMENTARY SCHOOL
541 N. 57TH STREET
KANSAS CITY, KS 66102

STATE OF MISSOURI
WILLIAM E. KNAPP
NUMBER PE-2004015662
PROFESSIONAL ENGINEER
05/06/20
William E. Knapp - Engineer
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KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS

KANSAS CITY, KANSAS

ISSUED FOR:

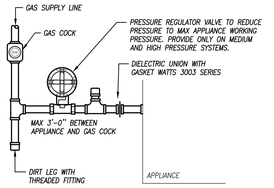
	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY: KJ
CHECKED BY: WK

SHEET TITLE: SCHEDULES/ DETAILS

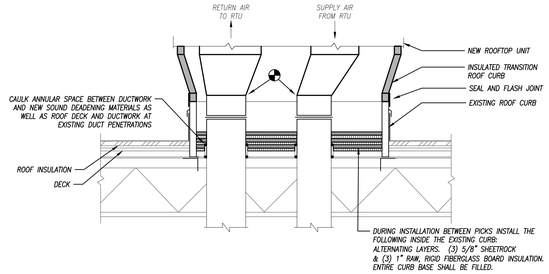
DATE: 05/06/20
PKMR PROJECT: 19.130

SHEET NUMBER: ME5



TYPICAL GAS CONNECTION

NOT TO SCALE



ROOFTOP UNIT TRANSITION CURB DETAIL

NOT TO SCALE

GENERAL HVAC NOTES

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5. ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.
6. ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.
7. DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.
8. PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.
9. FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.

OUTSIDE AIR / HVAC LOAD SCHEDULE

UNIT	# NAME	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		64	48
	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192			
								TOTAL	385	400		
RTU-2	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		64	48
	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192			
								TOTAL	385	400		
RTU-3	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		64	60
	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192			
								TOTAL	385	400		
RTU-4	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192		64	48
	CLASSROOM	520	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	192			
								TOTAL	385	400		
RTU-5	MULTIPURPOSE	1,373	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	10	20	447		97	75
	STAGE	381	EDUCATION	MUSIC/THEATER/DANCE	0.06	35	14	10	163			
								TOTAL	447	625		
RTU-6	CLASSROOM	1075	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	27	10	399		64	48
								TOTAL	399	400		

REMARKS:
1. VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3

HVAC PLAN KEYED NOTES

1. DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.
2. CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.
3. PROVIDE SIDE DISCHARGE UNIT TO MATCH EXISTING CONFIGURATION.

ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA E.S.P.	FAN DATA BHP	FAN DATA HP	COOLING COIL EAT (DB/WB)	COOLING COIL LAT (DB/WB)	COOLING COIL T/S CAPACITY	GAS HEATING INPUT (MBH)	GAS HEATING OUTPUT (MBH)	GAS HEATING EAT/LAT (°F)	FILTERS NO.	FILTERS THICKNESS	FILTERS SIZE	ELECTRICAL VOLTAGE/PHASE	ELECTRICAL MCA	ELECTRICAL MOCP	NOTES
RTU-1	YORK	ZJ049S	1,600	400	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	80.0	64.0	60 / 100	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7
RTU-2	YORK	ZJ049S	1,600	400	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	80.0	64.0	60 / 100	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7
RTU-3	YORK	ZJ061S	2,000	400	1.00	1.04	1 1/2	84 / 69	57 / 55	58.6 / 54.2	80.0	64.0	60 / 90	2	2"	20x30	208V / 3PH	29.3	40	1,2,3,4,5,6,7
RTU-4	YORK	ZJ049S	1,600	400	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	80.0	64.0	60 / 100	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7
RTU-5	YORK	ZR078S	2,500	625	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	97.0	60 / 95	2	2"	20x30	208V / 3PH	34.6	45	1,2,3,4,5,6,7,8
RTU-6	YORK	ZJ049S	1,600	400	1.00	0.82	1 1/2	84 / 69	57 / 55	47.5 / 43.2	80.0	64.0	60 / 100	4	2"	24x16	208V / 3PH	24.6	35	1,2,3,4,5,6,7

REMARKS:
1. COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.
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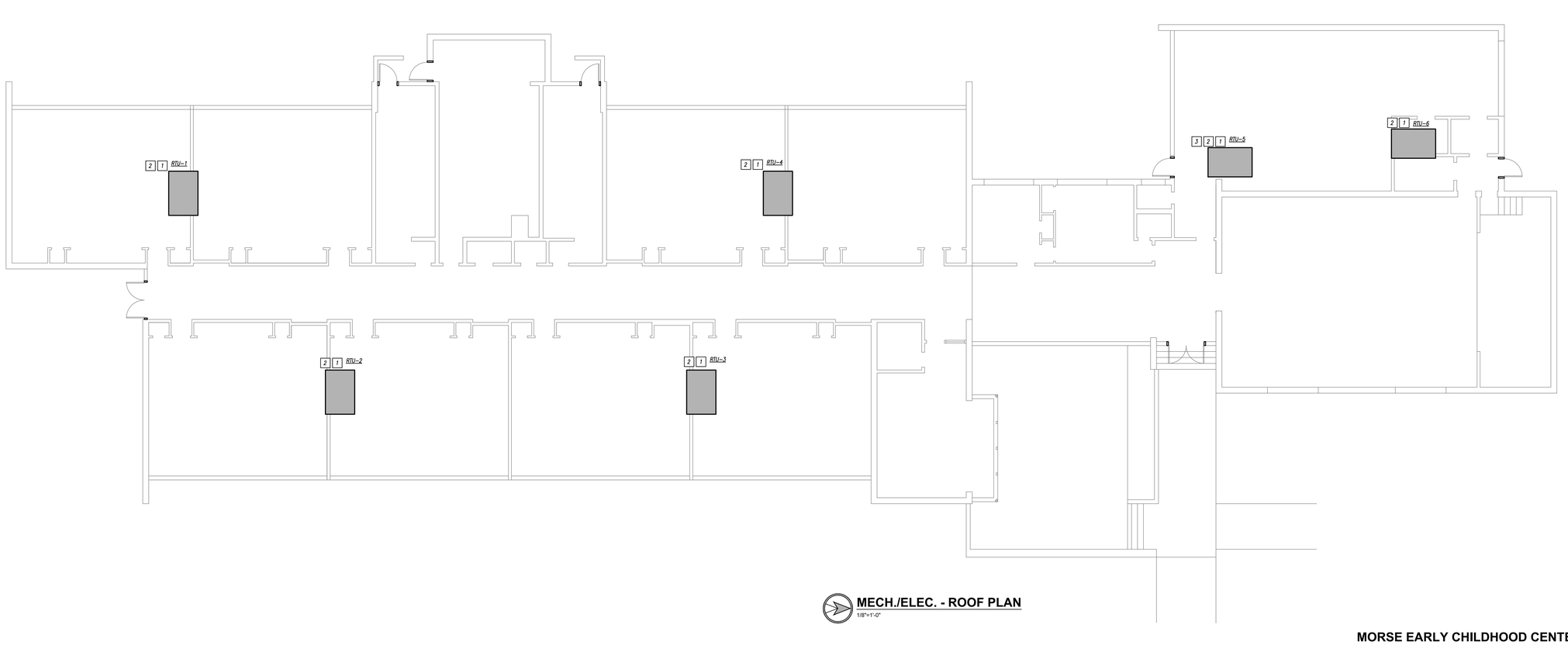
3. FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.
4. FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.
5. REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.
6. FURNISH WITH ECONOMIZER WITH POWERED RELIEF.
7. FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.
8. FURNISH WITH HOT GAS REHEAT.



MECH./ELEC. - ROOF PLAN

1/8"=1'-0"

STATE OF MISSOURI
WILLIAM E. KNEMEYER
NUMBER PE-2004015662
REGISTERED PROFESSIONAL ENGINEER
05/06/20
William E. Knemeyer, Engineer
MO# PE-2004015662

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
13300 W 98TH STREET LENEXA, KS 66215
913.492.2400 WWW.PKMRENG.COM

KANSAS CITY KANSAS PUBLIC SCHOOLS
ELEMENTARY SCHOOL ROOFTOP UNIT REPLACEMENTS
KANSAS CITY, KANSAS

MORSE EARLY CHILDHOOD CENTER
912 S BALTIMORE ST
KANSAS CITY, KS 66105

ISSUED FOR:

	DESCRIPTION	DATE
1		
2		
3		

DRAWN BY:	KJ
CHECKED BY:	WK

SHEET TITLE: MECH/ELEC ROOF PLAN

DATE: 05/06/20 PKMR PROJECT: 19.130

SHEET NUMBER: ME6

OUTSIDE AIR / HVAC LOAD SCHEDULE

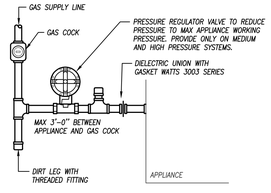
UNIT	# NAME	AREA	CATEGORY	SPACE DESIGNATION	IMC CFM / SQ. FT.	IMC DENSITY / 1000 SQ. FT.	DESIGN OCCUPANCY	IMC CFM / PERSON	OA CFM REQ'D	OA CFM PROVIDED	HEATING DESIGN LOADS (MBH)	COOLING DESIGN LOADS (MBH)
RTU-1	110 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163		96	72
	211 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
	311 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
								TOTAL	488	500		
RTU-2	112 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163		108	60
	213 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
	313 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
								TOTAL	488	500		
RTU-3	114 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163		108	60
	215 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
	315 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
								TOTAL	488	500		
RTU-4	116 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163		108	60
	217 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
	317 CLASSROOM	440	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	11	10	163			
								TOTAL	488	500		
RTU-5	104 ROOM	339	OFFICES	OFFICE SPACES	0.06	5	2	5	30		96	90
	208 CLASSROOM	500	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	13	10	190			
	205 OFFICE	219	OFFICES	OFFICE SPACES	0.06	5	2	5	23			
	309 CLASSROOM	721	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	19	10	277			
	306 TEACHERS	299	OFFICES	OFFICE SPACES	0.06	5	2	5	28			
								TOTAL	548	550		
RTU-6	134 ROOM	356	OFFICES	OFFICE SPACES	0.06	5	2	5	31		96	72
	229 CLASSROOM	699	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	18	10	264			
	318 CLASSROOM	719	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	18	10	266			
								TOTAL	562	565		
RTU-7	201 CORRIDOR	1983	PUBLIC	CORRIDORS	0.06	0	0	0	119		96	72
	301 CORRIDOR	1983	PUBLIC	CORRIDORS	0.06	0	0	0	119			
								TOTAL	238	250		
RTU-8	123 CLASSROOM	975	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	25	10	367		108	60
	129 LIBRARY	350	EDUCATION	MEDIA CENTER	0.12	25	9	10	132			
								TOTAL	499	500		
RTU-9	122 KINDERGARTEN	964	EDUCATION	CLASSROOMS (AGES 5-8)	0.12	25	25	10	366		96	48
								TOTAL	366	375		
RTU-10	220 STAGE	640	EDUCATION	MUSIC/THEATER/DANCE	0.06	35	23	10	268		122	150
	221 MULTI-PURPOSE	2000	AMUSEMENT	GYM, STADIUM, ARENA (PLAY AREA)	0.18	7	14	20	640			
								TOTAL	908	1250		

REMARKS:
1. VENTILATION DETERMINED BY GUIDELINES OF 2012 IMC TABLE 403.3

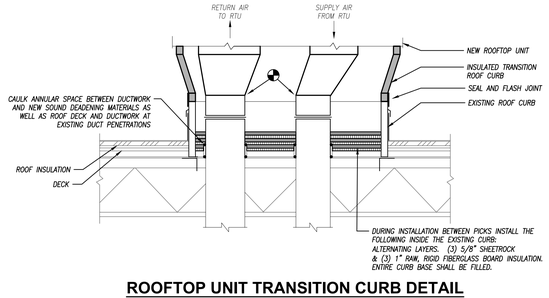
ROOFTOP UNIT SCHEDULE (GAS HEAT)

PLAN MARK	MANUFACTURER	MODEL	CFM	O.A. CFM	FAN DATA			COOLING COIL			GAS HEATING			FILTERS					NOTES
					E.S.P.	BHP	HP	EAT (DB/WB)	LAT (DB/WB)	T/S CAPACITY	INPUT (MBH)	OUTPUT (MBH)	EAT/LAT (°F)	NO.	THICKNESS	SIZE	MCA	MOCP	
RTU-1	YORK	ZJ078S	2,500	500	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 95	4	2"	24x20	34.6	45	1,2,3,4,5,6,7
RTU-2	YORK	ZJ061S	2,000	500	1.00	1.04	1 1/2	84 / 69	57 / 55	58.6 / 54.2	130.0	108.0	60 / 110	4	2"	24x16	29.3	40	1,2,3,4,5,6,7
RTU-3	YORK	ZJ061S	2,000	500	1.00	1.04	1 1/2	84 / 69	57 / 55	58.6 / 54.2	130.0	108.0	60 / 110	4	2"	24x16	29.3	40	1,2,3,4,5,6,7
RTU-4	YORK	ZJ061S	2,000	500	1.00	1.04	1 1/2	84 / 69	57 / 55	58.6 / 54.2	130.0	108.0	60 / 110	4	2"	24x16	29.3	40	1,2,3,4,5,6,7
RTU-5	YORK	ZJ090S	3,000	550	1.00	1.95	3	84 / 69	57 / 55	88.3 / 83.3	120.0	96.0	60 / 90	4	2"	24x20	41.9	50	1,2,3,4,5,6,7
RTU-6	YORK	ZJ078S	2,500	565	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 95	4	2"	24x20	34.6	45	1,2,3,4,5,6,7
RTU-7	YORK	ZJ078S	2,500	250	1.00	1.12	1 1/2	84 / 69	57 / 55	65.6 / 55.5	120.0	96.0	60 / 95	4	2"	24x20	34.6	45	1,2,3,4,5,6,7
RTU-8	YORK	ZJ061S	2,000	500	1.00	1.04	1 1/2	84 / 69	57 / 55	58.6 / 54.2	130.0	108.0	60 / 110	4	2"	24x16	29.3	40	1,2,3,4,5,6,7
RTU-9	YORK	ZJ049S	1,600	375	1.00	0.85	1 1/2	84 / 69	57 / 55	47.5 / 43.2	120.0	96.0	60 / 115	4	2"	24x16	24.6	35	1,2,3,4,5,6,7
RTU-10	YORK	ZJ150S	5,000	1,250	1.00	4.49	5	84 / 69	57 / 55	142.3 / 123.4	150.0	122.0	60 / 85	4	2"	24x20	70.0	90	1,2,3,4,5,6,7

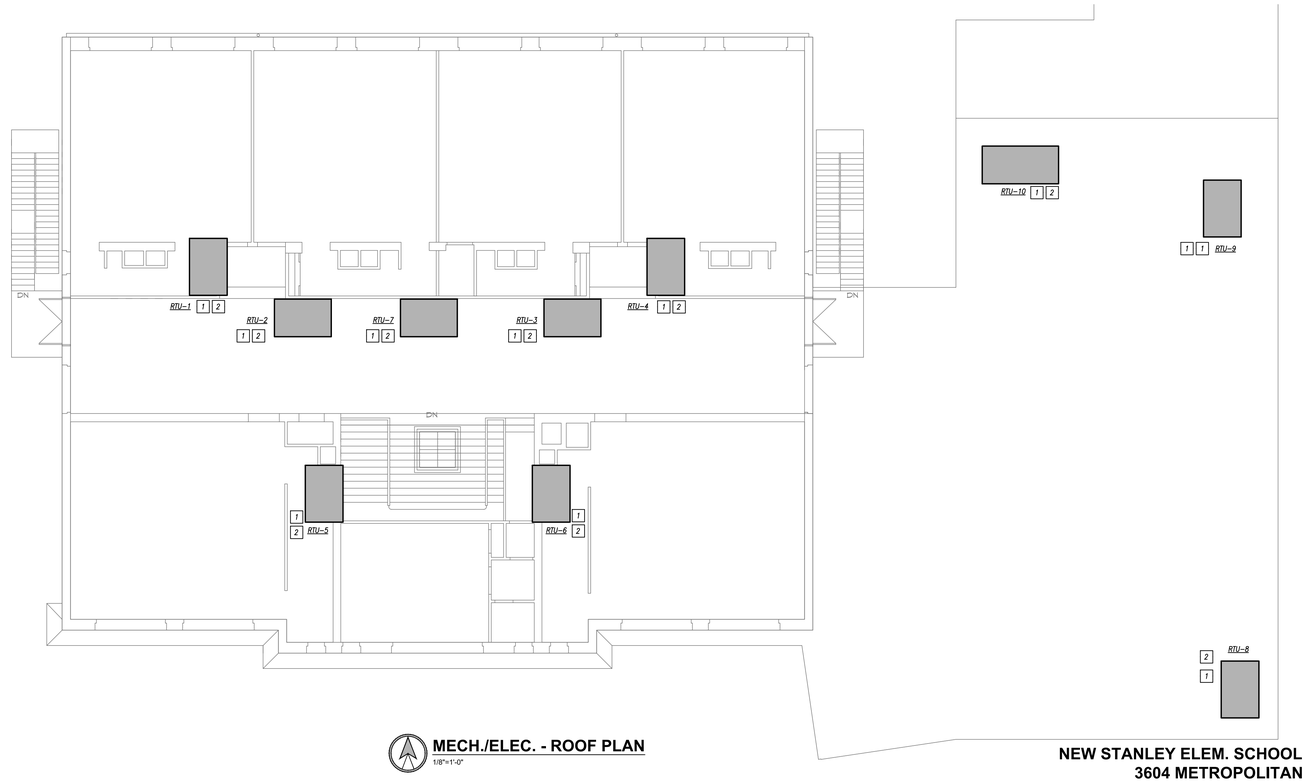
REMARKS:
1. COOLING CAPACITIES BASED ON 105° AMBIENT TEMPERATURE.
2. FURNISH WITH INTEGRAL SINGLE-POINT ELECTRICAL DISCONNECT.
3. FURNISH WITH STAINLESS STEEL HEAT EXCHANGER AND DRAIN PAN.
4. FURNISH WITH SINGLE-PIECE, FINNED CONDENSER COIL.
5. REMOVE CONTROLS FROM EXISTING UNITS AND REINSTALL AND RECONNECT TO NEW UNIT.
6. FURNISH WITH ECONOMIZER WITH POWERED RELIEF.
7. FURNISH WITH HINGED AND TOOLLESS ACCESS PANEL AND HAIL GUARDS.



TYPICAL GAS CONNECTION
NOT TO SCALE



ROOFTOP UNIT TRANSITION CURB DETAIL
NOT TO SCALE



MECH./ELEC. - ROOF PLAN
1/8"=1'-0"

GENERAL HVAC NOTES

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. ROUND BRANCH DUCT RUNOUTS AND FLEXIBLE DUCT SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.
3. MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0".
4. ALL RUNOUTS TO TERMINAL BOXES SHALL BE ONE SIZE LARGER THAN BOX INLETS UNLESS NOTED OTHERWISE.
5. ALL AIR DISTRIBUTION DEVICES SHALL HAVE LOCKABLE VOLUME CONTROL DEVICES.
6. ALL 90 DEGREE TURNING ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.
7. DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.
8. PROVIDE ACCESS DOORS IN DUCTS AHEAD OF ALL AUTOMATIC, FIRE, AND SMOKE DAMPERS.
9. FOR BALANCING THE OUTSIDE AIRFLOW QUANTITIES, REFER TO HVAC SCHEDULES.

PLAN KEYED NOTES

1 DISCONNECT GAS PIPING AND ELECTRICAL POWER FEED AND REMOVE EXISTING RTU. EXISTING GAS PIPING, ELECTRICAL, AND ROOF CURB TO REMAIN. REPLACE RTU WITH SIMILAR UNIT IN SAME LOCATION. RECONNECT GAS PIPING AND ELECTRICAL POWER FEED. SECURE RTU TO EXISTING WITH NEW TRANSITION CURB. REWORK EXISTING ELECTRICAL FEED TO UNIT AS NECESSARY TO ALIGN NEW UNIT CONNECTION. RECONNECT TO EXISTING FIRE ALARM FOR SHUT DOWN.

2 CONTRACTOR TO FIELD VERIFY POWER SOURCE OF EXISTING CONVENIENCE OUTLETS. PROVIDE GFCI CONVENIENCE OUTLETS TO MATCH EXISTING CONFIGURATION. COORDINATE WITH ROOFTOP UNIT ELECTRICAL REQUIREMENTS AS REQUIRED.

STATE OF MISSOURI
WILLIAM E. KENT
NUMBER PE-2004015662
PROFESSIONAL ENGINEER
05/06/20
William E. Kent - Engineer
MO# PE-2004015662

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SHEET TITLE: MECH/ELEC ROOF PLAN

DATE: 05/06/20
PKMR PROJECT: 19.130

SHEET NUMBER: ME7

NEW STANLEY ELEM. SCHOOL
3604 METROPOLITAN
KANSAS CITY, KS 66106