Addendum 01

DOCUMENT 00 91 00

DATE: October 12, 2026

PROJECT: Fairbanks Local Schools – Gym HVAC Replacement
11158 State Route 38
Milford Center, OH 43045

PROJECT #: 24045.03

OWNER: Fairbanks Local School District
Contact: Janel Chapman
9681 State Route 38
Milford Center, OH 43045

ARCHITECT: Garmann Miller
38 South Lincoln Drive
P.O. Box 71
Minster, Ohio 45865

TO: Prospective Bidders

This addendum form is a part of the Contract Documents and modifies the Construction Documents dated September 30, 2026, with amendments and additions noted below.

Acknowledge receipt of this Addendum on the Bid Form. Failure to do so may disqualify the Bidder.

This addendum consists of 5 pages, 31 specification sections, and 17 re-issued drawing sheets.

FOR INFORMATION ONLY

1. The pre-bid meeting sign-in sheet is attached.

CHANGES TO THE PROJECT MANUAL

1. Updated Section 00 01 10 – Table of Contents to reflect changes made to the specifications listed below.

2. Add Section 01 45 25 – Masonry Inspection Report in its entirety.

3. Add Section 04 05 13 – Masonry Mortaring in its entirety.

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4. Add Section 04 05 16 – Masonry Grouting in its entirety.
5. Add Section 04 20 00 – Unit Masonry in its entirety.
6. Add Section 05 50 00 – Metal Fabrications in its entirety.
7. Add Section 05 52 13 – Metal Pipe and Tube Railings in its entirety.
8. Add Section 06 10 00 – Rough Carpentry in its entirety.
9. Add Section 07 21 13 – Board Insulation in its entirety.
10. Add Section 07 21 29 – Sprayed Insulation in its entirety.
11. Add Section 07 62 00 – Sheet Metal Flashing and Trim in its entirety.
12. Add Section 07 92 00 – Joint Sealants in its entirety.
13. Add Section 09 21 16 – Gypsum Board Assemblies in its entirety.
14. Add Section 09 91 13 – Exterior Painting in its entirety.
15. Removed Section 22 08 00 – Commissioning of Plumbing in its entirety.
16. Updated Section 23 05 93 – Testing, Adjusting, and Balancing in its entirety.
17. Updated Section 23 07 13 – Duct Insulation in its entirety.
18. Removed Section 23 08 00 – Commissioning of HVAC in its entirety.
19. Updated Section 23 09 13 – Instruments and Control Elements, Article 1.05 SUMMARY, Paragraph D to explicitly state the intent of the Owner to tie into the existing front end BAS provided in Summer 2025.
20. Updated Section 23 09 93 – Sequence of Operations in its entirety.
21. Updated Section 23 37 00 – Air Outlets and Inlets in its entirety.
22. Updated Section 23 74 16 – Packaged Rooftop Air-Conditioning Units in its entirety.
23. Updated Section 26 01 01 – General Provisions in its entirety to remove references to Div 27 and Div 28 specifications.
24. Updated Section 26 05 05 – Minor Electrical Demolition in its entirety to remove references to items not in scope such as the cleaning of luminaires and modifications of telephone system.
25. Updated Section 26 05 26 – Grounding and Bonding in its entirety to remove references to Div 27.

26. Add Section 26 05 29 – Hangers and Supports in its entirety.

27. Updated Section 26 05 33.13 – Conduit in its entirety to remove references to Div 27 and removed FMC (Flexible Metal Conduit).

28. Updated Section 26 05 33.16 – Boxes in its entirety to remove references to floor boxes, ceiling outlet boxes, and boxes for technology.

29. Updated Section 26 05 50 – Basic Materials and Methods in its entirety to remove reference to Load Balancing.

30. Updated Section 26 05 53 – Identification in its entirety to remove references to Lighting devices and luminaires which are not in scope.

31. Updated Section 26 05 55 – Connectors in its entirety to remove unused section 'Related Requirements'.

32. Updated Section 26 27 26 – Wiring Devices in its entirety to remove references to Wall Switches and Technology/Telephone work that is not in scope.

33. Updated Section 26 28 16.16 – Enclosed Switches in its entirety to update manufacturer 'General Electric' to 'ABB'.

CHANGES TO THE DRAWINGS

1. Drawing Sheet G0.1 – Cover Sheet:
   a. Add sheets G1.0 and A0.1 to Sheet Index.

2. Drawing Sheet G1.0 – Code Plan:
   a. Add drawing sheet.

3. Drawing Sheet A0.1 – General Notes, Abbreviations, and Symbols:
   a. Add drawing sheet.

4. Drawing Sheet AD5.1 – Roof Demolition Plan:
   a. Reference revised sheet for added demolition work for new mechanical unit.

5. Drawing Sheet A5.1 – Roof Plan:
   a. Reference revised sheet for modified structural details 4/A5.1 and 5/A5.1.
   b. Reference revised sheet for modified guardrail detail 7/A5.1.
   c. Reference revised sheet for added general note.
   d. Reference revised sheet for added mechanical unit infill detail 6/A5.1.

6. Drawing Sheet PD1.1 – Overall Plumbing Demolition Plan:
   a. Reference revised sheet for additional gas piping work. Existing piping deemed undersized for new rooftop units.

7. Drawing Sheet P2.1 – Overall Plumbing Plan:
    a. Reference revised sheet for additional gas piping work. Existing piping deemed undersized for new rooftop units.

8. Drawing Sheet MD1.1 – Mechanical Demolition Plan – Unit A:
    a. Reference revised sheet for additional demolition work of HVAC controls.

9. Drawing Sheet MD1.2 – Mechanical Demolition Plan – Unit D:
    a. Reference revised sheet for clarifying keynotes.

10. Drawing Sheet M2.1 – Mechanical Plan – Unit A:
    a. Reference revised sheet for new location of mechanical control devices.

11. Drawing Sheet M2.2 – Mechanical Plan – Unit D:
    a. Reference revised sheet for additional structural and masonry work needed for the support of new RTU-D103.
    b. New ductwork to be acoustically lined.
    c. New wall mounted return grille to be painted to match existing wall color.

12. Drawing Sheet M5.1 – Mechanical Schedules:
    a. Reference revised sheet for new rooftop unit selections.
    b. Reference revised sheet for new outside air calculations resulting in new equipment selection.
13. Drawing Sheet M6.1 – Temperature Control Plans – Unit A:
    a. Reference revised sheet for updated location of mechanical control devices.

14. Drawing Sheet M6.2 – Temperature Control Plans – Unit D:
    a. Reference revised sheet for updated location of mechanical control devices.
    b. Reference revised sheet for new temperature control schematic for RTU-D103.

15. Drawing Sheet E1.1 – General Notes, Abbreviation, Legends, and Sheet Index:
    a. 1/E1.1 – Partial Electrical On-Line Diagram
        i. Includes MDMDB and HSMDB for indication of receptacle panelboards' source.
        ii. Includes Total Load after renovations for proof of non-overload condition.
    b. Electrical Equipment Symbols; Include "PB" Pullbox.
    c. Electrical General Notes; Added Notes "K" and "L" regarding existing conduits and new circuits that run across the roof.
    d. Panelboard Schedule "H1" circuits 26,28,30 and 32,34,36; Circuit breaker now 60A in coordination with Mechanical equipment selections. Feeder notes updated.
    e. Panelboard Schedule "H2" circuit notes; Note '1' format modified to match other panelboards in project.
    f. Panelboard Schedule "R" circuit notes; Circuit notes updated for specific project, 'E' for existing to remain and '1' for wire size of new circuit in scope of work.
    g. Panelboard Schedule "T" circuit notes; Circuit notes updated for specific project, 'E' for existing to remain and '1' for wire size of new circuit in scope of work.

16. Drawing Sheet E2.1 – Electrical Roof Plan:
    a. 1/E2.1 – Overall Electrical Roof Plan
        i. Expected roof box location added with 'PB'.

ii. Expected roof circuit shown and called out in keynote 8.
iii. One CO detection needed for Gas fired units RTU-A102, RTU-A101.
iv. RTU-D103 appearance clarified. Keynote for unit modified for its unique condition.
v. Keynote 6 included for disconnect switches to be provided by Electrical contractor.
vi. Keynote 7 added to the receptacles.
vii. Hid indication of panel 'GG', provided indication of entrance to room that contains panel 'T'.
viii. Indicate receptacles on RTU-A101 and RTU-A102 are on the same circuit using circuit line.

b. Power General Notes; Note 'A' modified for circuits that run along roof and need to comply with NEC 310.10(D).
c. Electrical Equipment Symbols; Include "PB" Pullbox.
d. 3/E2.1 – Duct Detector Detail
   i. Detail added for required Duct Detectors per cfm being over 2000.
e. Panelboard Schedule "T" circuit notes; Circuit notes updated for specific project, 'E' for existing to remain and '1' for wire size of new circuit in scope of work.

17. Drawing Sheet ED1.1 – Electrical Roof Demolition Plan – Overall:
    a. 1/ED1.1 – Overall Electrical Roof Demolition Plan
       i. Indication of existing to remain panel 'G' located below High School Gymnasium units.
       ii. Existing Pullbox location shown and keynote 3 added indicating scope of work.
       iii. Existing roof circuit pathway shown to indicate scope of work, Keynote 4 added.
       iv. Removed irrelevant tags on roof equipment getting demolished.
       v. Moved disconnect switches to clarify current existing location.
       vi. Indication of existing panel 'T'.
    b. 2/ED1.1 – Electrical Roof Circuit Detail
       i. Detail added to clarify intent for new construction circuits whose pathway runs along the roof.

ATTACHMENTS

The following attachments are included and are part of this addendum:

Pre-bid meeting sign-in sheet.

Specification Sections: 00 01 10, 01 45 25, 04 05 13, 04 05 16, 04 20 00, 05 50 00, 05 52 13, 06 10 00, 07 21 13, 07 21 29, 07 62 00, 07 92 00, 09 21 16, 09 91 13, 23 05 93, 23 07 13, 23 09 13, 23 09 93, 23 37 00, 23 74 16, 26 01 01, 26 05 05, 26 05 26, 26 05 29, 26 05 33.13, 26 05 33.16, 26 05 50, 26 05 53, 26 05 55, 26 27 26, 26 28 16.16

Drawing Sheets G0.1, G1.0, A0.1, AD5.1, A5.1, PD1.1, P2.1, MD1.1, MD1.2, M2.1, M2.2, M5.1, M6.1, M6.2, E1.1, E2.1, ED1.1

END OF ADDENDUM

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Sign-in Sheet

Project Name: Fairbanks LSD Gym HVAC Replacement
GM Project No.: 24045.03
Meeting Location: Fairbanks high school
Meeting Date: 10/8/2026

Purpose

Attendees

Name	Austin Nutter	Phone	(614) 496-2943
Business/Title	CMS Controls		
Email	austin.nutter@cms-controls.com		
Name		Phone	
Business/Title			
Email			
Name		Phone	
Business/Title			
Email			
Name		Phone	
Business/Title			
Email			
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Business/Title			
Email			

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END OF SECTION

MASONRY INSPECTION REPORT

Report No.:_____

Date:_____

Project:_____ Weather:_____

City, State:_____ Temp 7:00am:_____

Project No:_____ Temp 3:00pm:_____

Inspecting Agency:_____ Masonry Contractor:_____

Name of Inspector:_____ Superintendent:_____

Panel No.:					
On Grid Line:					
Between Grid Lines:					
Elev (Above Fin Flr):					
Nom CMU Size:					
CMU Laid Surface Dry					
Full Face Shell Mortar Bed Jt.					
Full Mortar Head Joint					
Cores Clear of Debris & Mortar					
Vert Reinf Bar Size					
Vert Reinf Bar Lap					
Centering Clips Used					
Grout Type (Coarse/Fine)					
Height of Grout Lift					
Grout Test Specimen No.					
Grout Vibrated					
Bond Beam Reinf Bar Size					
Bond Beam Reinf Bar Lap					
Spacers on Bond Beam Bars					
Reinf Lapped at Corners					
Bond Beams Grouted					
Masonry Anchors to Steel					
Masonry Lintel Reinf Tied					
Masonry Lintel Reinf Positioned					
Cores Grouted on Steel Lintel					
Cores Grouted Full Ht at Beams					
Remarks/Comments					

Insert y for Yes, n for No or sizes and dimensions as required. Insert N/A for not applicable

SECTION 04 05 13
MASONRY MORTARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 05 16 - Masonry Grouting

B. Section 04 20 00 - Unit Masonry

1.03 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

D. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2017.

E. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

F. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

G. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

H. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.

I. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry; 1995 (Reapproved 2013).

J. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

K. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2021.

L. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.

M. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; Current Edition.

N. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.08 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Hot Weather Requirements: Comply with IMIAWC (HW) .

PART 2 PRODUCTS

2.01 MORTAR APPLICATIONS

A. At Contractor's option, mortar may be field-mixed from packaged dry materials or made from factory premixed dry materials with addition of water only.

B. Mortar Color: Natural gray unless otherwise indicated.

C. Mortar Mix Designs: ASTM C270, Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
      a. Color: Natural gray color for non colored block
   2. Exterior Cavity Walls: Type S mortar with Type N pointing mortar.
      a. Color: Natural Gray
   3. Exterior, Loadbearing Masonry: Type S.
      a. Color: Natural Gray
   4. Exterior, Non-loadbearing Masonry: Type N.
      a. Color: Natural Gray
   5. Interior, Loadbearing Masonry: Type S.
      a. Color: Natural Gray
   6. Interior, Non-loadbearing Masonry: Type N.
      a. Color: Natural Gray

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Types as scheduled in this section.
   2. Color:
      a. Natural Gray

B. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Standard gray.

C. Water: Clean and potable.

D. Cold Weather Admixture: Non chloride, noncorrosive, accelerating admixture complying withASTM C494/C494M Type C.
   1. Acceptable Manufacturers:
      a. Euclid Chemical: ACCELGUARD 80
      b. Sika: SikaSet NC
      c. Master Builders Solutions: MasterSet FP 20
      d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Bonding Agent: Latex type.

F. Integral Water Repellent Admixture: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Performance of Mortar with Integral Water Repellent:
      a. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      b. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      c. Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
   2. Use only in combination with masonry units produced with integral water repellent admixture.
   3. Manufacturers:
      a. Sika: SikaMix AE-6
      b. GCP Applied Technologies: DRY-BLOCK Mortar Admixture
      c. Rheomix: Master Builders, Inc., Cleveland, Ohio
      d. Moxie International: Moxie Shield 1800 Admixture
      e. Krete Industries, Inc.: Krete Gard Mortar Mix
      f. SPEC MIX: IWR Integral Water Repellent Mortar
      g. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

F. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

G. Do not use calcium chloride in mortar.

2.04 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

3.02 INSTALLATION

A. Install mortar to requirements of section(s) in which masonry is specified.

B. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. The owner will employ services of an independent testing agency to perform specified testing and inspections

C. All mortar shall meet the "proportion specification" of ASTM C-270 and be made with portland cement/lime (non air-entrained). The use of masonry cement mortar is strictly prohibited. Use Type 'S' for walls below grade and Type 'N' for all other walls.

END OF SECTION

SECTION 04 05 16
MASONRY GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grout for masonry

1.02 RELATED REQUIREMENTS

A. Section 04 05 13 - Masonry Mortaring

B. Section 04 20 00 - Unit Masonry

1.03 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

D. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

F. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry; 2010.

G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used.

C. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.

1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.08 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Hot Weather Requirements: Comply with IMIAWC (HW).

PART 2 PRODUCTS

2.01 GROUT APPLICATIONS

A. At Contractor's option, grout may be field-mixed from packaged dry materials or made from factory premixed dry materials with addition of water only.

B. Grout Mix Designs:
   1. Bond Beams and Lintels: 2,500 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
      a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
      b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
   2. Engineered Masonry: 2,500 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
      a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
      b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.02 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Standard gray.

B. Grout Materials:
   1. Portland Cement: ASTM C150, Type I
   2. Grout Aggregate: ASTM C 404.
      a. Fine Aggregates: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
      b. Coarse Aggregates: Clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter. Maximum aggregate size 3/4 inch.
   3. Flyash: ASTM C618-89a, Type C or F may be substituted for up to 20 percent of the total cementitious materials in the grout mix.

C. Grout Coarse Aggregate: Maximum 3/8 inch size

D. Water: Clean and potable.

E. Cold Weather Admixture: Non chloride, noncorrosive, accelerating admixture complying with ASTM C 494 Type C.
   1. Acceptable Manufacturers:
      a. Euclid Chemical: ACCELGUARD 80
      b. Sika: SikaSet NC
      c. Master Builders Solutions: MasterSet FP 20
      d. Substitutions: See Section 01600 - Product Requirements.

F. Bonding Agent: Latex type.

2.03 GROUT MIXING

A. Grout Mixes shall be plant mix or factory blended (dry mix with water added at the site)

B. Mix grout in accordance with ASTM C94/C94M.

C. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
   1. Grout Proportions (by volume): Comply with Table 1, ASTM C476.
      a. Fine Grout: 1 part portland cement, 0 to 1/10 part hydrated lime or lime putty, 2-1/4 to 3 parts fine aggregate.

b. Coarse Grout: 1 part portland cement, 0 to 1/10 part hydrated lime or lime putty, 2-1/4 parts fine aggregate, 1 to 2 parts coarse aggregate.

2. Grout Slump: Properly proportioned grout shall have a slump of 8 to 10 inches.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

E. Do not use calcium chloride in grout.

2.04 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.

1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

3.02 INSTALLATION

A. Install grout to requirements of section(s) in which masonry is specified.

B. Do not install grout in lifts greater than 16 inches without mechanically consolidating.

C. Do not displace reinforcement while placing grout.

D. Remove excess mortar from grout spaces.

3.03 GROUTING

A. Use low-lift grouting techniques subject to other limitations of Contract Documents.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 43 00 - Quality Assurance.

B. The owner will employ services of an independent testing agency to perform specified testing and inspections

C. Test and evaluate grout using the Unit Strength Method (ASTM C1019) or the masonry assembly using the Prism Test Method (ASTM C1314).

1. Unit Strength Method: Test and evaluate grout in accordance with ASTM C 1019 procedures.

a. Sampling and testing for field quality control will be performed by the Contractor's testing laboratory during the placement of each type of grout fill, as follows:

1) Sampling Fresh Grout Fill: ASTM C 172.

2) Slump: ASTM C 143; one test for each grout load at point of discharge; and one for each set of compressive strength specimens.

3) Air Content: ASTM C 231; one for every other grout load at point of discharge, or when required by an indication of change.

4) Compressive Strength Tests: ASTM C 1019; one set of compression cubes for each 50 cubic yards or fraction thereof, of each mix design placed in any one day or for each 2,500 square feet of surface area placed, whichever provides more cubes.

(a) Specimens:

(1) One (1) specimen tested at 7 days.

(2) Two (2) specimens tested at 28 days

(3) One (1) specimen tested at the direction of the Architect.
(4) ASTM C 109; the testing laboratory will take a minimum of one set of 4 standard cubes for each compressive strength test, unless otherwise directed by the Architect.

(b) Adjust mix if test results are unsatisfactory and resubmit for review.
(c) Grout which does not meet the strength requirements is subject to rejection and removal from the Work at the expense of the Contractor.
(d) The Contractor shall provide all samples and conduct testing as required at no cost to the Owner. See Section 01410 for additional information.

5) Grout Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens is made. Comply with the requirements of Section 03300, Cast-In-Place Concrete for Cold and Hot Weather Placement.
6) Evaluation of Quality Control Tests:
(a) Do not use grout delivered to the final point of placement which has slump, temperature, or total air content outside the specified values.
(b) If the compressive strength tests fail to meet the minimum requirements specified, the grout represented by such tests will be considered deficient in strength and subject to removal, replacement, reconstruction, or to other action required by the Architect, all at the Contractor's expense.

b. Prism Test Method: Test masonry for compressive strength in accordance with ASTM C1314, perform tests and evaluate results as specified in individual masonry sections.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

1.02 RELATED REQUIREMENTS

A. Section 04 05 13 - Masonry Mortaring

B. Section 04 05 16 - Masonry Grouting

C. Section 05 50 00 - Metal Fabrications: Steel lintels.

D. Section 06 10 00 - Rough Carpentry: Nailing strips built into masonry.

E. Section 07 21 13 - Board Insulation: Insulation for cavity spaces.

F. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

1.04 REFERENCE STANDARDS

A. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2017.

B. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2021.

C. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2021.

D. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

E. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2022a.

F. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2021.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

H. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.

I. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

J. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2021.

K. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting two weeks before starting work of this section; require attendance by all relevant installers, architect and structural engineer.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for specified items.

C. Shop Drawings: Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Provide elevations of shear wall reinforcing.

D. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multi wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Hot Weather Requirements: Comply with IMIAWC (HW).

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Manufacturer: The concrete block manufacturer shall be a member of the National Concrete Masonry Association.
   1. Obtain masonry units from one manufacturer to provide uniform texture and color for each kind required for each continuous area and visually related area.
   2. All concrete masonry units in fire rated partitions shall be equal to UL Classification D-2 (2 hour)

B. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, control joint edges, and other detailed conditions.
      a. Use bullnose units at all exposed corners, window jambs and sills.
      b. Use special 45 degree corner units.
   3. Load-Bearing Units: ASTM C 90, normal weight.
      a. Normal weight, density 125 pcf or greater
      b. Hollow block, as indicated.
      c. Type II - Nonmoisture controlled
      d. Compressive Strength: 2600 psi. minimum average net area compressive strength.
      e. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Non-Loadbearing Units: ASTM C 90, normal weight
      a. Normal weight, density 125 pcf or greater

b. Both hollow and solid block, as indicated.
c. Compressive Strength: 2600 psi. minimum average net area compressive strength.
d. Exposed faces: Manufacturer's standard color and texture.

2.02 BRICK UNITS

A. Manufacturers:

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Efflorescence: ASTM C67, "non effloresced"
2. Color and texture: as selected by Garmann/Miller Associates Inc..
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

C. Brick Type 1
1. Brick Type 1: Belden Brick Company
a. Size: Norman- 2-1/4 x 11-5/8 x 3-5/8

D. Substitutions: See section 01 60 00-Product Requirements.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Mortaring: Refer to Section 04 05 13

B. Masonry Grouting: Refer to Section 04 05 16

2.04 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Clean reinforcement of loose rust

C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Cold Weather Construction: Comply with whichever is the more stringent:
1. The cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C, shall be implemented when the ambient temperature falls below 40 degrees F (4 degrees C)
2. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
3. Frozen Materials and Work:
a. Do not use frozen materials mixed or coated with ice or frost.
b. Do not build on frozen work.
c. Remove and replace masonry work damaged by frost or freezing.

B. Hot Weather Construction: Comply with whichever is the more stringent:

1. Hot Weather Construction: The cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C, shall be implemented when the ambient temperature exceeds 100 degrees F (37.8 degrees C), or 90 degrees F (32.2 degrees C) with a wind velocity greater than 8 mph (3.58 m/s).
2. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 INSTALLATION GENERAL

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns, and offsets.
   1. Avoid the use of less than half size units at corners, jambs, returns, offsets and where ever possible.

B. Thickness: Build masonry walls to the full thickness shown except single width walls to be nominal unit thickness.

C. Cut masonry units with motor driven saw designed to cut masonry with clean sharp unchipped edges.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Brick Type 1: Field Brick
      a. Bond: 1/3 Running.
      b. Coursing: Three units and three mortar joints to equal 8 inches.
      c. Mortar Joints: Concave.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
   1. Cut masonry units with a motor -driven saw designed to cut masonry.

H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or cavity insulation vapor barrier adhesive is applied.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.07 CONTROL AND EXPANSION JOINTS

A. Install control and expansion joints
   1. Where shown on the drawings
   2. In accordance with the Brick Industry Association (BIA) recommendations.
   3. In accordance with the National Concrete Masonry Association (NCMA) recommendations.

B. Do not continue horizontal joint reinforcement through control or expansion joints.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not shown, 3/8 inch wide and deep.

E. Column Isolation from Masonry: Continuously wrap steel columns or structural supports within masonry walls with expansion joint filler sheets (column isolation). Secure sheets with light gauge wire.

3.08 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Fill cores in hollow concrete masonry units with grout 3 course (24 inches) under bearing plates beams posts and similar items, unless otherwise indicated.

E. Do not build into masonry construction organic materials that are subject to deterioration.

3.09 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

C. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

D. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.10 CUTTING AND FITTING

A. Cut and fit for built in items and built in items. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 SOURCE QUALITY CONTROL

A. Masonry Contractor shall water test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe before capping wall.
   1. Contractor shall perform tests in the presence of, A/E, testing lab representative, and General Contractor.
      a. Do not proceed more than 3 veneer courses above flashing without testing, observation, and picture documentation by testing lab representative.

2. Contractor shall hold water hose and with standard water pressure force water into the cavity at a cell vent so water can be observed coming out adjacent weeps for a period of at least 5 minutes. Contractor shall continue down the wall to the next cell vent where a weep did not indicate water wicking out and continue this process until the entire length of flashing is tested.
3. Where water is observed inside the building or outside the building away from the weeps, masonry units shall be removed and flashing re-inspected and repaired.
4. Water test shall be re-performed where flashing was repaired.

3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 43 00 - Quality Assurance.
   1. The owner is to engage and compensate the on site testing agency.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

C. Masonry Inspection
   1. Provide masonry inspection of concrete or brick masonry walls as required to insure that masonry construction is in conformance with the Contract Documents.
   2. The masonry inspector shall prepare a written report or reports for each day of inspection. Masonry Inspection report that follows Section 01 45 25 shall be used for the reports.
   3. The masonry inspector shall be present and observe all grouting operations in wall requiring inspection. The masonry inspector shall be present at the project site with in sufficient time, in advance of grouting operations, to inspect the construction to insure its conformance to the Contract Documents and that grouting may proceed. Periodically the masonry inspector shall be present during the placement of masonry units and reinforcement.
   4. No grouting shall be permitted unless the masonry inspector is present and has indicated that the masonry construction is properly prepared for grouting operation.

3.13 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.14 PROTECTION

A. Protect installed units from splashing, stains, mortar, and other damage.

B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items including:
   1. Loose steel lintels
   2. Loose bearing and leveling plates
   3. Miscellaneous framing and supports

1.02 RELATED REQUIREMENTS

A. Section 05 52 13 - Metal Pipe and Tube Railings.

B. Section 09 91 13 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus. 2019

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

E. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

F. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

G. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.05 QUALITY ASSURANCE

A. The work of this section shall be coordinated with the work of other Sections.
   1. Verify the dimensions and work of other trades adjoining items of this Section before fabrication and installation.

B. Furnish to the pertinent trades items included in this Section that are built into the work of other Sections.

C. Welding shall be performed by qualified welders and shall conform to the applicable AWS welding code.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation

B. Repair items which have become damaged to the satisfaction of the Architect prior to incorporating them into the work. Replace damaged items if repair cannot be done to the satisfaction of the Architect.

1.07 PROJECT SITE REQUIREMENTS

A. Field measurements shall be taken at the job site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Angles, Channels, and S Shapes: ASTM A 36/A 36M - ASTM 992 (FY = 50ksi)

B. Steel W Shapes: ASTM A 992/A 992M (FY = 50ksi).

C. Rolled Steel Structural Shapes: ASTM A 992/A 992M (FY = 50ksi).

D. Plates and Bar: ASTM A 36, unless otherwise noted.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
   1. Properly mark and match mark materials for field assembly
   2. Use connections that maintain structural values of joined pieces

B. Fabricate items with joints tightly fitted and secured.
   1. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown.
   2. Form bent-metal corners to smallest radius possible without causing grain separation of otherwise impairing work.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware, screws, and similar items.

2.03 FABRICATED ITEMS

A. Lintels: As detailed; prime paint finish unless otherwise noted/scheduled.
   1. Fabricate loose structural-steel from steel angles and shapes indicated on the drawings.
   2. Weld adjoining members together to form a single unit.
   3. Size loose lintels to provide bearing at each side of opening equal to one-twelfth of the clear span, but not less than 8 inches.
   4. Galvanize after fabrication for use in exterior walls.

B. Loose Bearing and Leveling Plates

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete. Plates to be free from twist and warps and of required thickness and bearing area. Drill plates for receive anchor bolts and grouting.
2. Galvanize after fabrication for use in exterior walls.

C. Miscellaneous Framing and Supports
1. Provide steel framing and supports that are not part of the structural steel framework as necessary to complete the Work.
2. Fabricate miscellaneous units to sizes, shapes, profiles indicated and necessary to receive adjacent work or work to be retained by framing and supports. Fabricate from structural steel shapes, plates and steel bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, supports, attachments and similar items

2.04 FINISHES - STEEL

A. Prime paint steel items.
1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for galvanized finish.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
3. Exception: Galvanized items to be embedded in exterior walls or surfaces

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

END OF SECTION

SECTION 05 52 13
METAL PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof Equipment Safety Guardrails.

1.02 REFERENCE STANDARDS

A. AA DAF-45 - Designation System for Aluminum Finishes; The Aluminum Association, Inc.; 2003.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.

E. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

F. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications; 2021.

G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

H. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.03 QUALITY ASSURANCE

A. The work of this section shall be coordinated withe the work of other Sections.
   1. Verify the dimensions and work of other trades adjoining items of this Section before fabrication and installation.

B. Furnish to the pertinent trades items included under this section that are to built into the work of other sections.

C. Welding shall be performed by qualified welder and shall conform to the applicable AWS welding code.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation

B. Repair items which have become damaged to the satisfaction of the Architect prior to incorporating them into the work. Replace damaged items if repair cannot be done to the satisfaction of the Architect.

1.05 PROJECT SITE REQUIREMENTS

A. Field measurements shall be taken at the job site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
   2. Intermediate Rails: 1-1/2 inches diameter, round.
   3. Posts: 1-1/2 inches diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to roof blocking, provide backing plates for bolting anchors.
   2. Posts: Provide adjustable flanged brackets.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 ALUMINUM MATERIALS

A. Extruded Bars and Tubing: ASTM B221, Alloy 6063-T5/T2

B. Extruded Structural Pipe and Round Tubing: ASTM B429, Alloy 6063-T6

C. Plate and Sheet: ASTM B209, Alloy 6061-T6

D. Castings: ASTM B26, Alloy A356.0-T6

E. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. After fabrication, the welds and surrounding area shall be cleaned and buffed to blend withe adjacent finish.
   2. Rail to post connections shall be coped and fastened by continuous welds.
   3. Bends in the railing system shall be shown no distortion of the circular railing shape.

E. Provide spigots and sleeves to accommodate site assembly and installation. Field splices to be located within 8 inches of railing posts.

F. Provide anchors and plates required for connecting railings to structure.

G. Exposed Mechanical Fastenings: Provide flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

H. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

I. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

J. Interior Components: Continuously seal joined pieces by continuous welds.

K. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

L. Accurately form components to suit specific project conditions and for proper connection to building structure.

2.04 ALUMINUM FINISHES

A. Comply with AA DAF-45 for aluminum finishes required.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply items required to be secured to roof blocking with setting templates, for installation as work of other sections.

B. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

F. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.04 SCHEDULE

A. Roof mounted equipment safety rails: Anodized Alumi

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Concealed wood blocking, nailers, and supports.

C. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2016.

B. AFPA WCD No.1 - Manual for Wood Frame Construction; American Forest and Paper Association; 2001.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

F. PS 20 - American Softwood Lumber Standard; 2021.

G. SPIB (GR) - Grading Rules; 2014.

H. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2018.

I. WWPA G-5 - Western Lumber Grading Rules; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or moisture content less than 19 percent..

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
         1) Treat lumber exposed to weather.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. Treat lumber in contact with masonry or concrete.
      d. Treat lumber less than 18 inches above grade.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing.
      c. Treat plywood in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 CLEANING

A. Waste Disposal
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 07 21 13
BOARD INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at foundation perimeter, under floor slabs, cavity wall construction, and rainscreen wall construction.

B. Integral air and vapor barrier wall system with board insulation, foamed in place insulation, adhesive, flashing, and tape.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 07 21 29 - Sprayed Insulation: Sprayed-on, adhered fibrous insulation.

1.03 REFERENCE STANDARDS

A. ASTM C203 - Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation; 2005a (Reapproved 2012).

B. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2012.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

G. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

L. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation inside masonry cavity walls: Extruded polystyrene (XPS) board

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Continuous Insulation Board
   1. Application: Masonry cavity wall insulation.
   2. Extruded-Polystyrene Board Insulation: ASTM C 578
      a. Compressive resistance 25 psi (ASTM D1621)
      b. Thermal resistance: R-value of 5.0 per inch at 75 °F (ASTM C518).
      c. Water absorption: Max. 0.1% by volume (ASTM C272).
      d. Surface Burning Characteristics (ASTM E84)
         1) Flame spread: less than 25
         2) Smoke Developed: less than 450.
      e. Panel dimensions:
         1) Board thickness: 2 1/2”
         2) Board size: 15 3/4" x 96" square edge.
   3. Manufacturers
      a. Dupont: Styrofoam Brand Cavitymate Ultra XPS Foam Insulation; www.dupont.com
      b. Kingspan: Greenguard Type IV XPS Insulation Board; www.kingspan.com
      c. Owens Corning: Foamular CW25; www.owenscorning.com
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Provide all accessories that are approved per manufacturers installation instructions.

B. Adhesive: Provide insulation manufacturer's recommended adhesive.
   1. Product: The Dow Chemical Company GREAT STUFF PRO™ Gaps & Cracks single component insulating foam sealant where necessary

C. Joint Sealants
   1. LiquidArmor LT(low temp application)
      a. Fluid Applied with Trowel
      b. Installed during low temperature applications
      c. Used to create seamless barriers at rough openings of windows and doors as well as insulation joints.
      d. Can be used in temps as low as -20 degrees F
      e. Will withstand rain within 15 minutes of installation, however do not apply over wet surfaces.
      f. Complies with ASTM E331 and ASTM E2357.
      g. Shall be applied per manufacturers' recommendations and instructions
   2. LiquidArmor CM - (warm spray application)
      a. Can be sprayed between 40 degrees and 120 degrees F
      b. Read and follow all manufacturers's instructions
      c. Spray with a max of 3,300 PSI
      d. Apply minimum of four inches wide
      e. Apply at a minimum of 50 wet mills

D. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
   1. Products:
      a. The Dow Chemical Company "GREAT STUFF PRO™ Gaps & Cracks" single component polyurethane insulating foam sealant.
      b. The Dow Chemical Company "GREAT STUFF PRO™ Window & Door" single component polyurethane low-pressure foam sealant.

E. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam
   1. NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier.
   2. ASTM E-84 Class A
   3. Product: The Dow Chemical Company FROTH-PAK™ Foam Insulation two component, quick-cure polyurethane foam

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards vertically on foundation perimeter.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install in accordance to manufacturer's recommendations

B. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

C. Apply adhesive to back of boards:
   1. Three continuous beads per board length.

D. Install boards to fit snugly between wall ties.

E. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

F. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

G. Foam seal insulation board joints and protrusions or interruptions to the insulation plane to maintain continuity of air barrier.

H. Joint Sealant: For joints, gaps, and openings less that ½ inch (13 mm) wide, install continuous bead of joint sealant. Provide backer rod as required to prohibit joint sealant from bonding to a third surface.

I. Expanding Foam Sealant: For joints, gaps, and openings greater than ½ inch (13 mm) wide, install sealant in a continuous ribbon between adjacent board edges, working sealant in to joint for a full depth bead of sealant.

J. Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 29
SPRAYED INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellulosic insulation At junctions of dissimilar wall and roof materials..

1.02 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

B. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation; 2021a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on materials, describing insulation properties.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

B. Products Specified by Flammability Criteria: Listed and classified by ITS (DIR), UL (DIR), or authorities having jurisdiction (AHJ).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cellulosic Fiber Sprayed Insulation:
   1. GreenFiber: www.greenfiber.com/#sle.
   2. International Cellulose Corp: www.spray-on.com/#sle.
   3. ThermoCon, Inc: www.thermocon.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Cellulosic Fiber Insulation: ASTM C739; treated cellulosic fiber, white color.
   1. Thermal Resistance (R-value): 3.9, at 1 inch thick when tested in accordance with ASTM C177 at 75 degrees F temperature
   2. Density: 2 lb/cu ft, when tested in accordance with ASTM D1622/D1622M.
   3. Noise Reduction Coefficient (NRC): 0.75 for 1 inch thickness.
   4. Moisture Absorption: Maximum 15 percent by weight.
   5. Flame Spread / Smoke Developed Index: 0-25 / 0-450, Class A, when tested in accordance with ASTM E84.
   6. Combustibility: Passing ASTM E136.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Overcoat: Cementitious type, spray applied; flame spread / smoke developed index of 0-25 / 0-450, Class A, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

B. Verify other work on and within spaces to be insulated is complete prior to application.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from overspray or damage.

B. Install insulation stops between rafters at wall/sloped roof construction to prevent insulation from covering soffit vents or from limiting air circulation from soffit to attic space.

3.03 INSTALLATION

A. Install sprayed insulation in accordance with manufacturer's instructions.

B. Install sprayed insulation to a uniform monolithic density without voids.

C. Apply overcoat to a uniform thickness.

1. Apply overcoat monolithically and without voids; fully cover sprayed insulation.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied sprayed insulation.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, exterior penetrations, soffit and related trims, and other items indicated in Schedule.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Metal flashings embedded in masonry.

B. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.

C. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

E. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.08 WARRANTY

A. Provide a 20 year warranty for manufacturer approved 70 percent Kynar colors for the painted finish covering color fade, chalk, and film integrity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers:
   1. Fairview Architectural LLC; VitraEdge www.fairview-na.com/#sle.
   2. OMG Roofing Products; www.omgroofing.com/#sle.
   3. Petersen Aluminum Corporation; www.pac-clad.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) thick base metal.

B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.

C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Comply with manufacturers installation instructions, manufacturers recommendations and SMACNA 'Architectural Sheet Metal Manual'

B. Install in accordance with manufacturer's installation instructions.

C. Install work with provisions for thermal expansion of flashings, gravel stops, fascia, copings, reglets, and other items exposed for more than 20 feet of continuous length. Maintain as watertight installation at expansion seams.

D. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

E. Apply plastic cement compound between metal flashings and felt flashings.

F. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal metal joints watertight.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 FIELD QUALITY CONTROL

A. See Section 01 43 00 - Quality Assurance, for field inspection requirements.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide labor, materials and equipment necessary to complete sealant work, both interior and exterior of the Project.

B. Nonsag gunnable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings: Duct sealants.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

G. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

H. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2023.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

L. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, service temperature range, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a two (2) year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Joints and intersections between dissimilar materials that do not fit together with a hairline joint.
      f. Intersections of equipment that do not fit together or against adjoining material with a hairline joint.
      g. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Intersections of equipment that do not fit together or against adjoining material with a hairline joint.
      c. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.

c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
d. Joints where installation of sealant is specified in another section.
e. Joints between suspended panel ceilings/grid and walls.

B. General Project Recomendations
1. Type 1 - Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
2. Type 2 - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
3. Type 4 - Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Single source responsibility for joint sealant materials: Obtain joint sealant materials from a single manufacturer.

C. Compatibility: Provide joint sealant, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and experience.

2.03 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
5. Color: To be selected by Architect from manufacturer's standard range.
6. Service Temperature Range: Minus 20 to 180 degrees F.
7. Applications: Use for:
a. Metal to metal joint.
b. Glass to glass joints.
c. Sheet metal flashing, coping, preformed metal caps, fascia, extenders trim and panels.
d. Glass to metal joints.
e. Concrete to concrete, including precast panels
8. Manufacturers:
a. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: www.dow.com.
b. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com.
c. Sika Corporation; Sikasil WS-290: www.usa-sika.com.
d. Tremco, Inc.; Product Spectrum 2: www.tremcosealants.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Applications: Use for:

a. Control, expansion, and soft joints in masonry.
b. Joints between concrete and other materials.
c. Joints between metal frames and other materials.
d. Other exterior joints for which no other sealant is indicated.

6. Manufacturers:
a. Pecora Corporation; DynaTrol II: www.pecora.com.
b. Sika Corporation; Sikaflex-1a: www.usa-sika.com.
c. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com.
d. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com.
e. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com.
f. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
3. Applications: Use for:
a. Interior wall and ceiling control joints.
b. Joints between door and window frames and wall surfaces.
c. Other interior joints for which no other type of sealant is indicated.
4. Manufacturers:
a. Everkem Diversified Products, Inc; EcoTex 25: www.everkemproducts.com.
b. Pecora Corporation; AC-20 +Silicone: www.pecora.com.
c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gypsum wallboard.

B. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 07 21 13 - Board Insulation: Acoustic insulation.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

F. GA-216 - Application and Finishing of Gypsum Panel Products; 2016, with Errata.

G. GA-600 - Fire Resistance Design Manual Sound Control; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Refer to "Recommended Specification on Levels of Gypsum Board Finish" as published by the Gypsum Association (and AWCI/CISCA/PDCA) for finish levels required.

C. Recommended deflection limit for gypsum board assemblies is L/240.
   1. Tile finishes applied to cementitious backer units will require deflection limits of L/360 or less.

1.06 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board with ASTM C 840 requirements or gypsum board manufacturer’s recommendations, whichever is more stringent.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials.

D. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

E. If the application of gypsum board and gypsum shaft wall liner starts prior to the building being made weather-tight, the gypsum wallboard and/ or shaft wall liner specified shall be changed to glass-mat interior gypsum board and/ or glass mat gypsum shaft wall liner

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. PABCO Gypsum: www.pabcogypsum.com.
   6. USG Corporation: www.usg.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at all locations.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Edges: Tapered
      d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   4. Mold Resistant Paper Faced Products:
      a. American Gypsum Company; M-Bloc Type X.
      b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
      c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
      d. National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board.
      e. PABCO Gypsum; Mold Curb Plus Type X.
      f. USG Corporation; USG Sheetrock Brand Mold Tough Panels Firecode X.

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; friction fit type, unfaced.

B. Corner Beads: Zinc alloy. Products shall be similar to the following:
   1. Marino-Ware; Product CB Corner Bead: www.marinoware.com.
   2. Phillips Manufacturing Co; Product Everlast Corner Bead: www.phillipsmfg.com.
   3. 103 Deluxe Bead by Clark Dietrich Building Systems
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Edge Trim: L bead, as defined in ASTM C840. Products shall be similar to the following:
   1. Marino-Ware; Product L Trim: www.marinoware.com.
   2. Phillips Manufacturing Co; Product L-200 Trim: www.phillipsmfg.com.
   3. Clark Dietrich Building Systems; Product Metal Trim M20B
   4. Substitutions: See Section 01 60 00 - Product Requirements.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.
   3. Chemical hardening type compound.

E. Screws: ASTM C 1002; self-drilling type; cadmium-plated for exterior locations.

F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Provide framing immediately on both sides of joint and back with 2 inches of gypsum board strips to maintain fire resistance rating.
   2. Attach to framing with screws.
   3. Use longest practical lengths.
   4. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   5. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
   6. Ceiling abuts a structural element, dissimilar wall or partition or other vertical penetration.
   7. Construction changes within the plane of the partition or ceiling.
   8. Wings of L, U, and T shaped ceiling area are joined.

B. Corner Beads: Install at external corners, using longest practical lengths.
   1. Attach to framing with screws.

C. Edge Trim (Casing Bead): Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
   3. Taping, filling and sanding is not required at base layer of double layer applications.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 FINISH LEVEL SCHEDULE

A. Level 1: Above finished ceilings concealed from view.
   1. All joints and interior angles shall have tape set in joint compound. Surface is to be free of excess joint compound. Tool marks and ridges acceptable.

B. Level 2: Utility areas and areas behind cabinetry.
   1. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surfaces shall be be free of excess joint compound. Tool marks and ridges acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound.

C. Level 3: Walls scheduled to receive textured wall finish.
   1. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fasteners heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.

D. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish of wall coverings.
   1. All joints and interior angles shall have tape embedded in joint compound and two additional coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fasteners heads and accessories shall be covered with three separate coats of joint compound. The surface shall be smooth and free of tool marks and ridges.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

G. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five yearsdocumented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
3. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. Paints:
1. Behr Process Corporation: www.behr.com.
2. PPG Paints: www.ppgpaints.com.
3. Pratt & Lambert Paints: www.prattandlambert.com.
4. Sherwin-Williams Company: www.sherwin-williams.com/.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.

2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood, and primed metal.
1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
a. Products:
1) Behr Marquee Exterior Satin Enamel [No. 9450]. (MPI #15)
2) Pittsburgh Paints Acri-Shield Max Exterior Latex, 739-10 Series, Satin.
3) Rodda Protector Satin, 532201. (MPI #15)
4) Sherwin-Williams Resilience, Satin. (MPI #15)

B. Paint ME-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

2.04 PRIMERS

A. Primers: Provide the primer as required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

F. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 43 00 - Quality Assurance: Employment of testing agency and payment for

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. AABC MN-1 - National Standard for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems; Associated Air Balance Council; 2002.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

D. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2026.

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least once a week to Commissioning Authority and Garmann/Miller and Associates.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Draft “Pencil Copy” Report: Provide draft air balance report when the balancing is complete to the Engineer and Commissioning Authority for review before final report.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 01 43 00.
   2. Revise TAB plan to reflect actual procedures and submit as part of final report.
   3. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
   4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   5. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   8. Units of Measure: Report data in I-P (inch-pound) units only.
   9. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
   10. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, NEBB forms, or forms containing information indicated in Schedules.
   11. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Engineer: Garmann/Miller Architects-Engineers.
      g. Project Contractor.
      h. Project altitude.
      i. Report date.

G. Seasonal Testing: If initial TAB procedures were not performed during near peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near peak summer or winter conditions.

H. 11 month Warranty Walk: TAB to perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to report unusual conditions with recommendation of adjustments. TAB Contractor shall allow two (2) days for this work.

I. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting and balance dampers, control dampers, etc.

1.05 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
   1. Maintain one copy of each document on site.

B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience certified by AABC.

1.06 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.07 WARRANTY

A. Furnish AABC National Performance Guaranty for this project.

PART 3 EXECUTION

2.01 GENERAL REQUIREMENTS

A. The TAB contractor to be hired by the Division 23 mechanical contractor.

B. The Division 23 mechanical contractor shall be responsible to coordinate equipment startup and and any required equipment adjustments/modifications during balancing with the TAB contractor. All this associated time and materials shall be provided by the Division 23 contractor at no additional cost to the project.

C. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

D. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

E. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

F. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

G. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

2.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire, smoke and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of conditions.

2.03 PREPARATION

A. Provide additional balancing devices as required.

2.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

2.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

G. Seasonal Testing: If initial TAB procedures were not performed during near peak summer and winter conditions, perform additional testing, inspecting and adjusting during near peak summer or winter conditions.

H. 10 Month Warranty Walk: TAB to perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to report unusual conditions with recommendation of adjustments. TAB Contractor shall allow two days for this work.

2.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable speed fans, fans and motor pulleys shall be adjusted or replaced if required so that the motor is fully loaded at 100% speed. Balance to design airflow by adjusting maximum variable speed drive output below 100%.

N. Balancer is required to coordinate the developed air system static pressure setpoints with the temperature control contractor.

2.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Permanently mark settings of valves, dampers, and other adjustment devices allowing setting to be restored. Set and lock memory stops.

E. Effect system balance with automatic control valves fully open to heat transfer elements.

F. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

G. Pumps with variable speed drives (VFD) shall be balanced with all manual and control valves at 100% open. Triple duty valves shall be left at 100% open for all pumps with VFD's. The triple duty valve shall not be used for balancing VFD systems.

H. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

I. Systems installed with pressure independent control valves shall not require terminal level hydronic system balancing at equipment with the pressure indepedent valves. Field verify installation and operating differential pressure range of all pressure independent control valves. Total system flow shall be verified to be within +/-10% of system design. 100% of the total installed products shall be checked for individual conformance (clip settings on control valves are correct and match submittal). TAB contractor shall document comformity to the submittal. TAB contractor shall notify the temperature control contractor of any descrepancies. Any individual adjustments for the pressure independent valve assembly (valve and actuator combination) for field conditions shall be performed using the pressure independent control valve manufacturer's documented procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB)]

J. Balancer is required to coordinate the developed water system differential pressure setpoints with the temperature control contractor.

2.08 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Packaged Roof Top Heating/Cooling Units.
   3. Air Coils.
   4. Fans.
   5. Air Filters.
   6. Air Terminal Units.
   7. Air Inlets and Outlets.

2.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.
   6. Center to center distance, maximum, minimum, and actual.

C. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.

9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Air pressure drop, design and actual.

D. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

E. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

F. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

G. Duct Traverses:
   1. System zone/branch.
   2. Duct size.
   3. Area.
   4. Design velocity.
   5. Design air flow.
   6. Test velocity.
   7. Test air flow.
   8. Duct static pressure.
   9. Air temperature.
   10. Air correction factor.

H. Duct Leak Tests:
   1. Description of ductwork under test.
   2. Duct design operating pressure.
   3. Duct design test static pressure.
   4. Duct capacity, air flow.
   5. Maximum allowable leakage duct capacity times leak factor.
   6. Test apparatus:
      a. Blower.
      b. Orifice, tube size.
      c. Orifice size.
      d. Calibrated.
   7. Test static pressure.
   8. Test orifice differential pressure.
   9. Leakage.

I. Air Distribution Tests:
   1. Air terminal number.
   2. Room number/location.
   3. Terminal type.
   4. Terminal size.
   5. Area factor.
   6. Design velocity.
   7. Design air flow.
   8. Test (final) velocity.
   9. Test (final) air flow.
   10. Percent of design air flow.

J. Sound Level Reports:
   1. Location.
   2. Octave bands - equipment off.
   3. Octave bands - equipment on.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - HVAC Identification.

B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

I. ASTM E 119 (UL 263) - Standard Test Methods for Fire Tests of Building Construction and Materials.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

K. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or ASTM E84.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Fiber Glass
   2. Johns Manville Corporation
   3. Owens Corning Corp
   4. CertainTeed Corporation
   5. Manson
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C553; glass fiber flexible, limited combustibility blanket.
   1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Minimum 1.0 PCF Density
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
   3. Secure with UL listed pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Fiber Glass
   2. Johns Manville Corporation
   3. Owens Corning Corp
   4. CertainTeed Corporation
   5. Manson
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C 612; rigid, board.
   1. 'K' Value: 0.27 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Minimum 3.0 PCF Density
   3. Maximum Service Temperature: 450 degrees F.
   4. Maximum Water Vapor Absorption: 5.0 percent.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
   3. Secure with UL listed pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 DUCT LINER

A. Manufacturers:
   1. Knauf Insulation; Model Atmospheric Duct Liner
   2. Johns Manville Corporation; Model Linacoustic RC
   3. Owens Corning Corp
   4. CertainTeed Corporation: www.certainteed.com/#sle.
   5. Manson
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Non-corrosive, limited combustibility glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1 inch Thickness: 0.45.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. All insulation shall be applied so that there is no fiberglass exposed to the air stream without filters downstream. All fiberglass insulation, including all exposed edges, shall be coated, or mylar or other suitable material shall be provided between fiberglass and the air stream.

D. Insulate ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints except where prohibited by code.

E. Insulate ducts conveying air above ambient temperature:
   1. Provide with standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

F. External Duct Insulation Application:
   1. Provide vapor barrier jacket. Cover with aluminum jacket with seams located on bottom side of horizontal ductwork.
   2. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier mastic.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings and Where Noted on Drawings:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

B. Exhaust/Relief Ducts Exposed to Outdoor Air:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

C. Outside Air Intake Ducts:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

D. Plenums/Air Transfers:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.
   3. Flexible Glass Fiber Duct Liner Insulation: 1 inches thick, where denoted on drawings.
   4. Rigid Glass Fiber Duct Liner Insulation: 1 inches thick, where denoted on drawings.

E. Supply Ducts:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.
   3. Flexible Glass Fiber Duct Liner Insulation: 1 inches thick, where noted on the drawings.
   4. Rigid Glass Fiber Duct Liner Insulation: 1 inches thick, where noted on the drawings.

F. Ducts Exposed to Outdoors:
   1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
   2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

END OF SECTION

SECTION 23 09 13
INSTRUMENTS AND CONTROL ELEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure Independent Control Valves (PICCV)
B. Pressure Independent Control Valves (ePIV)
C. Pressure Independent Control and Balance Valves (PICBV)
D. Control valves.
E. Control valve operators
F. Control dampers.
G. Damper operators.
H. Transmitters
I. Meters
J. Building Automation System
K. Building Automation Equipment
L. Temperature Control Wiring
M. Miscellaneous accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls.
B. Section 23 0553 - HVAC Identification
C. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gauge taps.
D. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.
B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
C. ASHRAE Standard 135-2008 BACnet Protocol.
D. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Control Diagrams
    1. Submit to the Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
    2. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

3. Submittals shall be prepared on, or folded to, 8-1/2 inch by 11 inch size and bound in brochure form. Electronic form, pdf format, shall also be included.
4. DDC logic and control diagrams shall be included for all equipment and sequences of control. Include at a minimum all points shown on DDC control drawings. If any additional points are required to complete the sequence of operation, the control equipment needed to provide this information shall be provided.
5. Upon completion of the Work, provide the complete, accurate, and approved diagrammatic blueprinted layouts on the automatic control system specified herein and as installed. Layouts shall show all control equipment including job installation changes, and the function of each system shall be indicated. Layouts and descriptions shall be included in the project record set and in the operating and maintenance manuals.

C. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as flash memory. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Provide submittals within 12 weeks after contract award.

D. 100% completed points lists and sequences shall be submitted no later than the point at which system installation is 50% completed.

E. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module including, but not limited to the following equipment and components indicating arrangements, capabilities, range, voltage, horsepower, and construction.
1. Valves
2. Thermostats
3. Relays
4. Panels
5. Gauges
6. Sensors
7. Dampers
8. Switches
9. Pressure Controllers
10. DDC microprocessor
11. Unitary DDC controllers
12. Actuators
13. Blade Server (Supervisory Controller)
14. Laptop Workstation
15. Wiring

F. Schedule of motor operated dampers, complete with all performance information.

G. Wiring diagrams and layouts for each control panel.

H. Floor plan schematic diagrams indicating field sensor, controller and power supply locations.

I. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

J. Contractor shall make themselves familiar with the commissioning specification and include appropriate time to work with the commissioning agent.

K. Provide information noting items utilizing BACnet technology are BTL certified and listed.

L. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. After drawings are finalized, provide drawings in pdf format. Include a list of all unit default safety and control settings, whether fixed or adjustable, as shipped from the factory. Where field modifications are required to meet the specification, provide all modification labor and materials, and submit a complete, detailed, step-by-step procedure for modifications.
   3. Drawings shall also be installed in workstation as web pages.

M. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
   1. As-built versions of the submittal product data.
   2. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
   3. Operator’s manual with procedures for operating control systems: logging on and off, handling alarms, producing point/object reports, trending data, overriding computer control, and changing setpoints and variables.
   4. Programming manual or set of manuals with description of the programming language and syntax of statements for algorithms and calculations used of point/object database creation and modification, of program creation and modification, and editor use.
   5. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points/objects, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
   6. Documentation of all programs created using custom programming language including setpoints, tuning parameters, and object database.
   7. Graphic files, programs and database on magnetic or optical media.
   8. List of recommended spare parts with part numbers and suppliers.
   9. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
   10. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
   11. Licenses, guarantee, and warranty documents for equipment and systems.
   12. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
   13. Operation & Maintenance manuals shall also be installed in workstation as web pages.

N. Warranty: Submit manufacturers warranty (minimum of five years equipemtn only) and ensure forms have been filled out in Owner's name and registered with manufacturer.

O. After the control submittal has been reviewed and marked "No Exceptions Taken" by the design engineer, the controls contractor shall submit all graphics required for the temperature control system. The graphics shall be reviewed by the owner, commissioning agent, and the design engineer. The temperature control contractor shall not install any graphics until they have been reviewed and approved by the owner, commissioning agent and design engineer.

P. Provide a schedule of work indicating at a minimum the intended sequence of work, start dates and durations for individual activities, delivery dates for major materials and equipemnt

including anticipated lead times and milestones indicating possible restraints on work by other trades or construction delays.

1.05 SUMMARY

A. General: The control system shall be as indicated on the drawings and described in the specifications.

B. The intent of this specification and related sections is to provide a fully integrated, open, interoperable, peer-to-peer networked, distributed Direct Digital Control System. The following communication protocols are acceptable:
   1. ANSI/ASHRAE Standard 135 BACnet - A Data Communication Protocol for Building Automation and Control Networks
   2. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard

C. The BACnet operating stack must be embedded directly in each individual DDC device at the media access controller level and in all operator interface and and configuration applications.

D. It is the Owner's express goal to integrate into the existing open system that will allow products from various suppliers to be integrated into to a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The existing system was installed in 2025 by Prime Building Controls. It is the responsibility of the Division 23 contractor to coordinate all connections with the existing front end system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the JACE, N4 Supervisor, and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. The Owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier, by Tridium Inc.

E. The Network Controller (NWC) shall connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely shall be accomplished through standard Web browsers and/or the N4 Supervisor, via the Internet and/or local area network.

F. Each NWC shall communicate to BACnet (B-AAC, B-ASC), devices and/or other open protocol systems/devices as described on the contract drawings and/or in the specifications.

G. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems for Owner.

H. The control system shall accommodate a minimum of 5 simultaneous multiple user operation utilizing standard web-browser clients. Access to the control system data should be limited only by user ID and operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any work-station on the school's network and have access to all appropriate data. All users shall have an unique ID and password. Owner shall provide user information and permission levels ninty days prior to scheduled completion.

I. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, the loss of any other controller, or the school district network, the control system shall continue to independently operate under control.

J. Communication between the control panels and all work-stations shall be over a high speed 100 Mpbs (at minimum) Ethernet network. All nodes on this network shall be peers. The

operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.

1. The communication network wiring between control panels, and equipment controls with BACnet communication cards (chiller control panel, boiler control panels, domestic water heaters, and VFD's) shall be provided and installed by the temperature control contractor. The use of the owner's network for communication between devices shall be prohibited. Provide a single point of communication between the owner's network and the DDC control system network.

K. Temperature control contractor shall be responsible for the following:

1. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.
2. Providing of a complete DDC electronic automatic temperature control system.
3. Control of heating water system, variable speed pumps, air handling units, rooftop air handling units, cabinet heaters, exhaust fans, and Variable Refrigerant Volume Systems along with other miscellaneous equipment as denoted on drawings in accordance with requirements herein specified.
4. Providing of control devices, valves, instruments, and the like, as herein specified and as required to comply with required sequences of automatic control.
5. Providing of wiring for secondary control devices, relay switches, safety low limit controls, etc., and such interlock wiring required.
6. Provide all control wiring between all primary network controllers and equipment furnished with Bacnet control panels. Provide a single point connection to owner's LAN.
7. Wire controls for the water pumps including the Variable Frequency Drives.
8. Coordinate communication requirements for the air handling units controls that are provided by the air handling unit manufacturer.
9. Tag all automatic controls, instruments, safeties, panels, actuators and relays. Key to control schematic. Refer to specification 23 0553 - HVAC Identification
10. Furnish adequate supervision on Work performed for him by others to insure proper operation and the neatest and best possible arrangement.
11. Testing and maintenance of system as herein specified.

L. The documentation is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions and sequences shown.

M. The Temperature control contractor shall provide the following control valves:

1. Air Handling Unit Heating and Cooling Coils: Pressure Independent Characterized Control and balance valves with P/T ports or Pressure independent characterized control valves with seperate P/T ports on both side of valve.

1.06 QUALITY ASSURANCE

A. The temperature control contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems as herein specified. The installation of the control system shall be performed by an authorized dealer of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number, and sequence of operation all bearing the name of the manufacturer.

B. All materials and equipment used shall be standard components, regularly manufactured for the specified system. All systems and components shall have been thoroughly tested and proven in actual use of at least 2 years.

C. The temperature control contractor shall read all other Drawings and Specifications, become familiar with requirements and scope of the Project, and include such coordination work as may be required.

D. Designer Qualifications: Design system under direct supervision of a Control Engineer experienced in design of this work and is certified by control system manufacturer.

E. Project managers and project engineers sahll be officially trained and certified by the BAS manufacturer in the design, installation, programming and operation of the BAS components and have atleast five years experience in DDC installation projects with point counts similar to this project and systems of the same character as this project.

F. Project technicians shall be officially trained and certified by teh BAS manufacturer in the installation, programming an doperation of the BAS components.

G. Installer Qualifications
   1. Installing contractor shall have an established working relationship with control system manufacturer of not less than 5 years.
   2. Installing contractor and his sub-contractors shall have successfully completed manufacturer's control system training. Provide certification of completed training, including hours of instruction and course outlines, with bid.
   3. Installing contractor shall have an office within 75 miles of the project site and provide 24 hours response in the event of a customer call, 7 days per week, 365 days per year.

H. Documentation certifing that all of the above qualifications are met is required to be submitted to the engineer. All submittals and shop drawings shall be considered unapproved (whether reviewed and returned by ther engineer or not) until proper documentation proving all qualifications are met has been submittal.

I. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., UL-916 Energy Managment Systems, UL-864UUKL Smoke Systems as suitable for the purpose specified and indicated and shall comply with NFPA 70.

J. Systems utilizing BACnet technology shall be BTL certified and comply with ASNI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for building Automation and control networks.

K. Systems utilizing Lonworks shall not be permitted.

L. Damper components shall meet the requirements of AMCA 500.

M. Control systems shall meet the requirements of ASHRAE Standard 90.1.

N. Performance Standards. System shall conform to the following minimum standards over network connections:
   1. Graphic Display. A graphic with 20 dynamic points/objects shall display with current data within 10 seconds.
   2. Graphic Refresh. A graphic with 20 dynamic points/objects shall update with current data within 8 seconds.
   3. Object Command. Devices shall react to command of a binary object within 2 seconds. Devices shall begin reacting to command of an analog object within 2 seconds.
   4. Object Scan. Data used or displayed at a controller or workstation shall have been current within the previous 6 seconds.
   5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 seconds
   6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 second. Select execution times consistent with the mechanical process under control.

7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 seconds of other workstations.

1.07 CONTRACTOR RESPONSIBILITIES

A. The temperature control contractor shall be responsible for final design drawings, installation of all control wiring and control devices in accordance with National Electric Code. The temperature control contractor shall also be responsible for startup and complete checkout, and commissioning of the systems.

B. This Contractor shall furnish complete drawings, component lists, specification sheets and sequences of operation to the Architect/Engineer for approval before start of installation.

C. All DDC logic diagrams shall be updated as built and included in the Operation and Maintenance Manuals for the Owner.

D. The temperature control contractor is responsible to use all room numbers developed and approved by the owner in the development of the temperature control system for this building.

E. The Temperature Control Contractor shall work hand-in-hand with the commissioning agent during their work on the project. The laptop provided shall be setup for access to the temperature control system for use by the commissioning agent.

F. The temperature Control Contractor shall provide labeling for all control system sensors, panels, actuators, etc. The label names shall match the point names given on the computer and as shown on the temperature control drawings.

G. The temperature control contractor shall contact the boiler manufacturer to integrate the cotnrol and monitoring points specified in the sequence of operations. The connection to the boiler controller shall be thru BACnet/IP, BACnet over ARCNET, BACnet MS/TP.

H. The temperature control contractor shall provide all control valves, balance and control valves, differential pressure controllers balance valves, as indicated on drawings.

I. Sizing of Valves: Valves shall be furnished to the Division 23- Mechanical Contractor who will mount them as piping is installed. Valves sizes shall be as recommended by the Temperature Control Contractor who shall be responsible for their proper sizing, regardless of indicated valve or line size on the drawings. Water valves shall not exceed 5 psi pressure drop, unless otherwise stipulated.

J. The BAS contractor shall provide a single set of all tools and instruction in the use of these tools required to interface with the system for the purposed of test and balance.

K. The BAS contractor shall provise a qualified technician to assist in the test and balance for a period of eight hours or until the first twenty terminal units have been balanced.

1.08 SOFTWARE LICENSE AGREEMENT

A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to the owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. The owner shall receive a copy or multiple copies licensed to them of any local programming tool required to replace or program local controller.

B. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into an unified system in order to provide flexibility for expansion, maintenance, and service of the system.

C. OPEN NIC STATEMENT: All Niagra 4 software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"; "accept.wb.in=*"; "accept.wb.out=*". All open NIC statments shall follow Niagra Open NIC specifications.

D. All Niagra 4 frameworks shall have the "Niagra Compatibility" set to the following:
   1. Station Compatibility In = All
   2. Station Compatibility Out = All
   3. Tool Compatibility In = All
   4. Tool Compatibility Out = All

E. The owner shall be named license holder of all software associated with any and all incremental work on the project(s). The owner shall receive a copy or multiple copies licensed to them of any local programming tool required to replace or program local controller.

F. In addition, the owner shall receive ownership of all job-specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project.

G. The owner shall be provided with all usernames and passwords required from complete and unlimited access to the system.

1.09 PRE-SUBMITTAL MEETING

A. The temperature control contractor shall review the sequence of operation and note any exceptions or planned deviations from the specified sequence. Prior to creating the control submittal the control contractor shall contact the design engineer and setup a meeting to discuss the exceptions and planned deviations. The design engineer will not review any submittals until after this meeting has taken place.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five years period following owner acceptance of entire building.

C. A five year warranty (equipment only) on all equipment covered by this specification section.

D. All licensing necessary to provide routine updates, upgrades, and bug fixes to all software and firmware for a period of five years shall be provided.

E. Temperature control contractor shall provide support for operation of the system and improvements to energy usage to the owner throughout the first two years of operation after the date of substantial completion.

1.11 MAINTENANCE SERVICE

A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The design intent is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-2008 BACnet protocol in one open, interoperable system. System shall be capable for future extension by other manufacturer's and shall not be write-protected.

B. Control Manufacturers (Certified by BACnet testing laboratory):
   1. Tridium Niagara 4 Vykon - JACE 8000
   2. Siemens - Talon
   3. Honeywell - Spyder PUB / PVB Series Bacnet Controllers, WEB-8000 Supervisory.

4. Delta Controls, Inc. - DAC / DVC / DFC / DNT Bacnet Controllers
5. Distech - ECB, RB, and PFC Series, EC-BOS-8
6. Reliable Controls - MachPro 1 / 2 / Zone / Air
7. Carrier Controls - I-Vu
8. Trane Tracer

C. Substitutions: Not permitted.

D. All temperature control systems shall be installed by the factory authorized installer or representative serving the Central Ohio, OH Area.

2.02 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 CONTROL PANELS

A. Control cabinet/enclosure shall be extruded aluminum, galvanized steel or factory-hardened plastic with key locks and hinged doors. Electric panels shall be of code gauge steel construction with UL label. Panels shall be labeled with nameplates and legends as required.
   1. The control cabinet/enclosure shall be required to house devices not enclosed as a part of the DDC building automation system panels. Prewire with internal wiring terminated at labeled terminal strips. Thermometers and switches shall be mounted on the cover of the panel. Relays, transformers, and components shall be mounted inside the panel. Devices, whether interior or exterior, shall be provided with legend plates of engraved formica or equal. Cabinets shall be located as approved by the Architect/Engineer or as indicated on the Drawings.
   2. Local type panels need not contain graphic representations or symbols, unless specified below, but must contain approved nameplates, legends, etc., for each device.
   3. Where panels contain any wiring, panels shall be UL approved cubicles.

B. Provide common keying for all panels.

2.04 CONTROL VALVES

2.05 PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES (PICCV)

A. Acceptable Manufacturers:
   1. Belimo
   2. Bell & Gossett
   3. Danfoss
   4. IMI Hydronics / TA
   5. Substitutions: See Section 01 6000 -

B. NPS 2 and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.

C. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.

D. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances, and valve hysteresis

E. Flow Characteristics: Equal percentage characteristics.

F. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow.

G. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).

H. Provide P/T ports on both sides of PICCV valve if not included within valve.

I. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).

J. A wet calibrated electronic flow meter shall provide dynamic feedback to measure flow and verify performance.

K. The control valve shall require no maintenance and shall not include replaceable cartridges.

2.06 ELECTRONIC PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES (EPIV)

A. Acceptable Manufacturers:
   1. Belimo
   2. Bell & Gossett
   3. Danfoss
   4. IMI Hydronics / TA
   5. Substitutions: See Section 01 6000 -

B. NPS 2 and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.

C. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.

D. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances, and valve hysteresis

E. Flow Characteristics: Equal percentage characteristics.

F. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow.

G. Water coil optimization shall be accomplished by utilizing a pressure independent control valve assembly; two temperature sensors providing feedback of coil inlet and outlet water temperatures; and an electronic flow meter to provide analog flow feedback. Software shall control the valve to avoid the coil differential temperature from falling below a programmed set point, The valve assembly shall be capable of accepting an analog signal representing the coil power required. Real-time data and configuration of valve operating parameters shall be available by means of BACnet MS/TP, BACnet/IP or HTTP. Monitored points shall include, but not be limited to inlet and outlet coil water temperatures, absolute flow, absolute valve position, absolute coil power and total heating/cooling energy in BTU/hr. Configuration points shall include but not be limited to valve, flow, and power settings. Historical trend data shall be stored for up to 13 months and be retrievable in a standard time-stamped format.

H. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).

I. Provide P/T ports on both sides of PICCV valve if not included within valve.

J. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).

K. A wet calibrated electronic flow meter shall provide dynamic feedback to measure flow and verify performance.

L. The control valve shall require no maintenance and shall not include replaceable cartridges.

2.07 PRESSURE INDEPENDENT CONTROL AND BALANCE VALVE (PICBV)

A. Acceptable Manufacturers:
   1. IMI Hydronics / TA (TA-Fusion P / TA-Modulator)
   2. Delta T
   3. Danfoss
   4. Substitutions: See Section 01 6000 - Product Requirements

B. The control valve shall be provided with an adjustable stepless, pre-settable balancing and built-in dp-controller. It shall be supplied and installed as shown on the drawings to ensure proper balancing and performs the control function for water flows.

C. The valve shall be pressure independent with integral spring and diaphragm arrangement for integral differential pressure control over built in control section.

D. The flow for fully open control part shall be adjustable down to 20% of maximum flow.

E. The valve shall have retained EQM characteristic for all recommended settings.

F. Test points shall be provided for measuring differential pressure and be integral with the body and incorporate means for positive leak tight shutoff when not in use.

G. True flow measurement verification must be possilbe with balancing instrument. Flow deviation max +/- 10% at full open.

H. The valve shall have a rangeability of minimum 50 for all recommended pre-settings.

I. The valve shall have the capacity for manual, leak tight shutoff without the actuator attached for maintenance purposes and to allow measurement of available differential pressure for diagnostics.

J. It should be possible to perform a high speed flush with the valve installed in the system without causing damage to the product and without removing / replacing any parts.

K. The valve shall have a pressure balanced cone to provide low force actuating and easy maneuvering.

L. The valve shall have a minimum valve authority rating of 0.3.

M. Material: Valve body with connection in sizes 1 1/2" to 2" shall be made in dezincification resistant alloy brass with a pressure rating of 235 psi. Sizes 2 1/2" - 6" shall consit of ductile iron housings and stainless steel valve plugs with a pressure rating of 365 psi. The minimum differential pressure shall be 5 psi.

N. Material: Valve body and insert with connection sizes 3/8" to 1 1/4" shall be of dezincification resistant alloy brass with stainless steel valve plug, spindle, and spring. EPDM membrane and o-rings with a pressure rating of 230 psi. The minimum differential pressure shall be 5 psi.

O. Threaded connections shall be NPT in accordance with ANSI/ASME B1.20.1-1983.

P. All valves shall be manufactured in accordance with ISO 9001 and ISO 14001.

Q. Valve actuators shall be full modulating, low voltage (24VAC) and compatible with control valve.

R. For valve sizes 2" and smaller, the controls contractor shall provide coil hookup packages as provided by the control valve manufacturer. The supply side of the coil shall contain a strainer/drain and an integrated isolation ball valve/manual air vent with a P/T port. The return side of the coil shall contain a union fitting with a P/T port and manual air vent, pressure-independent balancing control valve, and shutoff valve.

2.08 DAMPERS - ALL EXCEPT RELIEF AIR APPLICATIONS

A. Dampers shall be low leakage type, as required to meet the requirements of ASHRAE Standard 90.1, not less than 22 gauge galvanized steel frames.

B. Performance: Test in accordance with AMCA 500-D.

C. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.

D. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.

E. Blade Seals: Synthetic elastomeric or neoprene mechanically attached, field replaceable.

F. Jamb Seals: Spring stainless steel.

G. Shaft Bearings: Oil impregnated sintered bronze or nylon bushings.

H. Linkage Bearings: Graphite impregnated nylon or oil impregnated sintered iron.

I. Leakage: Dampers shall be low leakage dampers and shall be designed for tight shut-off such that for a 1500 FPM damper leakage does not exceed 1 percent at 6 inches w.g.

J. Maximum Pressure Differential: 6 inches wg.

K. Temperature Limits: -40 to 200 degrees F.

L. Modulating dampers shall be opposed blade type.

M. Whenever possible, damper size shall match ductwork size. The Temperature Control Contractor shall verify air velocity and notify the engineer of sizing concerns prior to installation of dampers

N. Automatic dampers installed in equipment furnished by the manufacturer shall be checked for proper size and design by the Temperature Control Contractor. Should any features of these dampers appear to be unsatisfactory, full details shall be given to the Engineer in writing and suggestions made for any necessary corrections.

2.09 DAMPERS - ALL RELIEF AIR APPLICATIONS

A. Extruded aluminum (6063-T5) damper frame shall not be less than 0.080” (2.03 mm) in thickness. Damper frame shall be 4” (101.6 mm) deep x 1" (25.4 mm), with duct mounting flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

B. Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.

C. Blades shall be maximum 6" (152.4 mm) deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 0.06” (1.52mm). Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29. All blades shall be symmetrically pivoted.

D. Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper.

E. Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

F. Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

G. Hexagonal control shaft shall be 7/16" (11.11 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

H. Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.

I. Dampers shall be designed for operation in temperatures ranging from -40°F (-40°C) to 212°F (100°C).

J. Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

K. Dampers shall be opposed blade action or parallel blade action, as indicated on the plans.

L. Dampers shall be Flanged to Duct install type only.

M. Design based on TAMCO Series 9000 BF Thermally Insulated Damper with Thermally Broken Frame.

2.10 DAMPER OPERATORS

A. General: Provide smooth proportional control with "continuous control action" and sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Actuator response shall be linear in response to sensed load and damper stroke shall be smooth and efficient throughout it's entire range. Damper operators shall be electronic, direct coupled type designed for 100,000 full stroke cycles at rated torque, low voltage type. Provide spring return for two position control and for fail safe operation. Damper operators on outside air intakes shall spring return closed.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 25 sq ft damper section.
   3. Damper operators on outside air intakes and exhaust outlets where required shall be spring return closed.

B. Size for torque required for damper seal at load conditions with one actuator per damper section. .Mechanically paralleled or ‘piggybacked’ actuators are not permitted.

C. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.

D. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.

E. Power Requirements: 0.23A (running) and 0.09A (holding) at 24V-ac or 27 VA (running) and 10 VA (holding) at 120V-ac.

F. Actuator timing shall be 15 sec.

G. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 350ºF [250ºF].

H. Proportional Smoke Damper Actuators shall meet all requirements specified above and shall modulate 0-100% open in response to a 2-10vdc or 4-20mA control signal. A 2-10vdc feedback output shall provide a 2-10vdc signal for position indication.
   1. Power Requirements (Proportional): Maximum (running) 12 VA at 24-V ac or 8 W at 24-V dc. Maximum (holding) 5VA at 24-V ac or 3 W at 24-V dc.
   2. A manual override winder and locking mechanism shall be provided for override operation of the actuator on a loss of power.

2.11 RELAYS

A. Where required, provide relays for energizing or re-energizing the various branch circuits in response to master control panels. Relays shall be UL labeled and sized for not less than 140 percent of the connected amperage load. Relays shall be rated for the system voltage and have proper throw and poles.

2.12 TRANSMITTERS

A. Electronic Temperature Sensors
   1. Provide temperature sensors and other temperature indicating sensors of commercial grade quality located at the point of measurement and installed according to the manufacturer's recommendations. Sensors to be vibration and corrosion resistant.
   2. Thermistor temperature accuracy shall be +/-0.36 F between the range of 32.0 - 158.0 F.
   3. Provide temperature sensors such that the BAS shall be able to convert the resistive input signal available from the element into a digital signal for use by the BAS.
   4. Provide outside air temperature sensors with a watertight fitting and adequate protection from the effects of solar radiation.
   5. Provide water temperature sensors of the bulb type, mounted within stainless steel wells filled with a heat conductive compound and in direct contact with the water within the pipe.
   6. All field mounted sensors shall be labeled as to their function and name used in the control program.

B. Electronic Room Temperature Sensors
   1. Room Temperature Sensors shall be used in classrooms, office spaces, kitchen spaces, student dining, and gymnasiums.
   2. Temperature sensors shall be equal to PreCon type-IV thermistors utilizing a 20K ohm thermistor or platinum RTD's of 2000 ohm resistance.
   3. Housing: Sensors shall be manufactured in a durable epoxy housing and shall be enclosed for protection from elements when installed in the sensors operating environment. The sensor cover shall be provided with tamperproof screws. Sensors shall not include a display or keypad.
   4. Temperature sensors shall be provided with an override button that will switch the mechanical system into occupied mode of control. Other than the override button the thermostat face shall be blank, with temperature adjustment, readout panels, etc.
   5. Sensor cover shall be color "Pure White".

C. Electronic Wall Plate Temperature Sensors
   1. Wall Plate Temperature Sensors shall be used in corridors, vestibules.
   2. Temperature sensors shall be equal to PreCon type-IV thermistors utilizing a 20K ohm thermistor or platinum RTD's of 2000 ohm resistance.
   3. Housing: Concealed in wall with stainless steel louvered cover plate. 1/4" closed cell foam insulation backin.

D. Electronic Duct Temperature Sensors

1. All duct sensors shall be true averaging type sensors with capillary lengths not less than 20 feet long. The only exceptions will be return air, and outdoor air sensors, which may be single point temperature sensors.
2. All duct sensors shall be installed within enclosures that are suitable for the application.

E. Electric Thermostats
1. Electric thermostats shall be line voltage type of single pole single throw design.
2. The sensing element shall be liquid-filled.
3. Covers and base plates shall be of standard design and finish.
4. Electric thermostats shall be denoted on the Drawings with a sub "E".
5. Electric thermostats (where noted) for operation of propeller unit heaters and cabinet unit heaters shall be provided by temperature control contractor and installed by the Division 26 electrical contractor.
6. Sensor cover shall be color "Pure White".

F. Electric Reverse Acting Thermostats
1. Electric thermostats shall be line voltage type of single pole single throw design.
2. The sensing element shall be liquid filled.
3. Covers and base plates shall be of standard design and finish.
4. Adjustable temperature dial.
5. Reverse acting thermostats shall be denoted on the drawings with sub "R".
6. Reverse acting thermostats shall be provided by temperature control contractor and installed by the Division 26 electrical contractor.
7. Sensor cover shall be color "Pure White".

G. Sensor Guards
1. Provide guard of clear color, mounted with back frame to wall and tamperproof screws on all wall mounted sensors located in gymnasiums, student dining, locker rooms, and corridors where wall plate sensor not utilitzed. Also, where denoted on the Drawings with a sub "G".

H. Safety Low Limit Thermostats
1. Automatic reset safety low limit thermostats with flexible sensing elements shall serpentine full length of duct or coil. Instrument to be sensitive to lowest temperature at any 12 inch increment on its 20 foot length. Thermostat shall have a range of 34 degrees F. to 60 degrees F. with a fixed 5 degrees F. differential. Provide one for every 20 square feet of coil.
    a. Safety low limit thermostats shall be capable of being reset through software at the building energy management computer.

I. Electronic Pressure Sensors
1. Provide pressure sensors and other pressure indicating sensors of commercial grade quality located at the point of measurement and installed according to the manufacturer's recommendations.
2. Provide pressure sensors of the direct acting or reverse acting, unidirectional or bidirectional type such that the BAS shall be able to convert input signal into a digital signal for use by the BAS.
3. Provide pressure sensors utilizing the smallest possible operating range which will sufficiently cover the range required for normal operating conditions.
4. Provide pressure sensors of the ultra precision type with a tolerance at 70 degrees F of no greater than plus/minus .8 percent of full scale and an end-to-end accuracy of plus/minus 2 percent of full scale.

J. Duct Differential Pressure/Air Velocity Transmitters

1. Differential Pressure/Air Velocity Transmitters shall be provided by the Temperature Control Contractor to monitor the difference between two pressures, duct air veloctiy and generate a linear output proportional to the difference in pressures.
2. Design range shall be -5 inches water column to 4 inches water column.
3. Minimum accuracy shall be +/-1.0 percent of calibrated span. Includes combined effects of linearity, hysteresis and repeatability.
4. Unit shall be provided with a LCD display.

K. Humidity Sensors
1. Shall be a "Current Type" humidity transducer. Sensor shall produce a linear 4-20mA current representing the span of the sensor. This signal shall be produced by the sensor itself through a current converter supplied with the sensor.
2. Space humidity sensor shall be enclosed in a durable enclosure for mounting in interior zones. Sensor shall have a range of 0 to 100 percent relative humidity and shall be accurate with + 2 percent of span.
3. Duct humidity sensor shall be a probe type with all wiring enclosed in an electrical box. Sensor shall have a range of 0 to 100 percent with an accuracy of + 3 percent of span.
4. Outdoor humidity sensor shall be enclosed in a weather proof enclosure for mounting outdoors. Sensor shall have a range of 0 to 100 percent with an accuracy of +/- 3 percent of span.

L. Carbon Dioxide Sensors
1. Sensor type shall be Non-dispersive infrared (NDIR), diffusion sampling with a measurement range from 0-2000 PPM.
2. Minimum Accuracy: +/- 75 PPM of calibrated span.
3. Input Voltage: 20 to 30 VAC/DC; 100 mA max.
4. Analog Output: 0-5 VDC, 0-10 VAC or 4-20 mA user selectable.
5. Sensor shall have self-calibrating capabilities.
6. Sensor shall have capability of sensing an alarm to the BAS in the event of a calibration problem or malfunction.
7. At the time of Project Completion, the TCC shall verify the calibration of all CO2 sensors.
8. TCC to verify with sensor manufacturer the best signal wiring to be used to prevent signal irregulatities and errors.

M. Current Status Switch
1. Shall be capable of detecting changes in flow of current to motors in determining accurate and reliable equipment status.
2. Ampere rating for 2.5 - 135 amps continuous.
3. Sensor supply voltage shall be included from monitor conductor.
4. Minimum current required is 1 amp.
5. Trip setpoint shall be adjustable to +/- 1 percent of range.

N. Air Flow Monitoring Station - Indoor Units
1. Manufacturers:
   a. Tek-Air
   b. Paragon Controls (OA-FE-1500, FE-1000, FE-1050, FIT-1003D)
   c. Ebtron (GTx116-P+)
   d. Air Monitor (VOLU-flo/OAM, VOLU-probe/VS Pitot, Veltron DPT 2500)
   e. Kele (KOAMS, KMS)
2. Air flow measuring system including microprocessor panel, signal processor with CFM output and air flow measuring sensor struts as required to measure outside air intake, Return air, and exhaust air flow as denoted on the drawings.

3. Air flow measuring system shall have velocity range from 200 to 2000 ft./min. with duct measurement accuracy (including repeatability, zero offset, and temperature compensation) of plus or minus 3 percent.
4. The location, type and quantity of flow sensing elements shall be per ASHRAE Standard 111 and subject to actual field measurements.
5. Outside Air Measurement: Provide where indicated air flow stations similar to above specifications except where three straight runs of duct are not present, provide large area impact sensing probes between outdoor louver and damper (one probe per 16 square feet of louver) with NEMA-4 transducer located in the outside air stream with temperature sensor and microprocessor based monitor to generate a 4-20 ma signal linear to cfm that has been corrected for air density. Provide access for cleaning of impact probes.
6. TCC shall verify all air velocities are above the minimum (fpm) allowed by the selected AFMS. The minimum air flow must be used for the verification. If a minimum airflow determined by the balancer yields a velocity below the minimum allowable by the AFMS, the TCC shall have the min airflow adjusted such that it does not fall outside of the limits of the AFMS. The TCC shall coordinate this with the balancer and it shall be noted in the balance report.

O. Remote Water Differential Pressure Transmitter (DPT)
1. The Basis of design varible speed pumps have integral sensorless control and do not require DPTs. If another pump manufacturer is used these may be required.
2. Differential Pressure Transmitters shall be provided by the temperature control contractor and installed by the Division 23-mechanical contractor. Transmitters to be completely self-contained, variable capacitance type. Wiring terminals and electronics shall be in separate compartments, so the electronics remain sealed during installation. Reverse polarity protection shall be included to keep wiring mishaps from damaging the transmitter. The 4-20mA DC signal shall be transmitted over a pair of No. 22 gauge or larger wire directly to the control enclosure.
3. Design range shall be as required by system. External zero and span adjustments, over pressure to 2,000 PSI and no humidity effects.
4. Minimum accuracy shall be +/-0.25 percent of calibrated span. Includes combined effects of linearity, hysteresis and repeatability. Stability shall be +/-0.25 percent of upper range limit for 6 months. No internal mechanical linkages shall be used in the transmitter.

P. Flow Meter (FT)
1. Flow sensosr shall be supplied and wired by the temperature control contractor and installed by the mechanical contractor where indicated on the drawings or as required by the sensor manufacturer.
2. The flow sensor shall utilize a nonmagnetic sensing mechanism with a forward-swept rotating impeller to produce a frequency signal proportional to flow. The flow sensor shall have an achievable accuracy of +/-1 percent of flow rate with flow velocities of 1 to 30 fps.
3. The flow sensor shall be constructed of brass with a glass reinforced impeller, tungsten carbide shaft and glass reinforced polyphenylene sulfide housing.
4. Provide minimum of 10 straight pipe diameters upstream and 5 diameters downstream for each field installed flow transducer.

Q. Building Static Pressure Transmitter:
1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

2.13 BUILDING AUTOMATION SYSTEM

A. Furnish a complete Direct Digital Control system.

1. The entire system shall be totally DDC with electric/electronic actuation. No pneumatics shall be utilized except where noted on the associated drawings.
2. The DDC System shall support the ASHRAE Standard 135-1995 BACnet protocol.
3. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.
4. The Local Area Network shall be a 100 Mpbs Ethernet network.
5. The system shall be backward compatible. Whenever a system upgrade is provided, the system shall be capable of communicating to existing device level controllers without the requirement to provide any new equipment and controllers.
6. The system shall be capable of operating on the latest version of IE explorer, Firefox, or Google Chrome. System shall be capable of operating without JAVA.
7. All licensing necessary to provide routine updates and bug fixes to all software and firmware for a period of five years shall be provided.
8. Network minimum physical and media access requirements:
    a. Ethernet; IEE standard 802.3 & 820.1W
    b. Cable; category 5e minimum throughput; 100 Mbps

B. The following HVAC equipment shall be controlled by the Building Automation System including sequences. A graphic shall be provided for each piece of equipment listed below:
1. Air Handling Units.
2. Heating Water System.
3. Unit Ventilators
4. Fan Coil Units
5. Exhaust Fans
6. Cabinet Heaters
7. Unit Heaters

C. Operator Workstation
1. Data Network Equipment Contractor to furnish a dedicated virtualized server located at 4-5 building currently under construction to host web services and storage for temperature control use at minimum (1 TB) partition. Temperature Control Contractor shall be responsible to coordinate with Data Network Equipment Contractor and the owner's representative on requirements for server. Temperature Control Contractor to coordinate with Data Network Equipment Contractor for server resource requirements. Data Network Equipment Contractor to provide Microsoft Operating System only. Temperature Control Contractor to provide all necessary programming, additional licensing, and software required for a fully functional system.
2. A laptop computer shall be provided as part of this project. This contractor shall install network server software on the laptop as part of this project to allow interface with this project. Provide any additional cables necessary to connect to any of the controllers on the system. The laptop shall be made available to the commissioning agent for their use as well.
    a. Critical alarms shall be reported to the laptop, cell phones, and email accounts of the maintenance department employees. All critical alarms shall be wired so that unit fans, pumps, etc. cannot be turned on in hand mode when safety device is tripped.
    b. The laptop computer shall include the ability to access the temperature control system via the owners network. User interface shall be seamless and the user shall be capable of performing all functions that can be performed locally.
3. The computer designated shall be used for command entry, information management, network alarm management, and data base management functions. All real-time control

functions shall be resident in the standalone DDC panels to facilitate greater fault tolerance and reliability.

a. The laptop computer shall have a minimum Intel Core i5 processor with a 500.0 GB hard drive, 8 GB Ram, 24x CD-RW/DVD drive, parallel port, serial port, USB port, wireless 802.11 A/G/N network card, an RJ45 10/100/1000 internal network card, and high capacity Lithium Ion battery. The laptop shall include a minimum 15.4" WXGA LCD panel. Furnish Nylon laptop carrying case. Acceptable manufacturers shall be IBM/Lennovo, HP, Dell, and Toshiba. Computer platform shall be certified by DDC system manufacturer. Furnish Microsoft Windows 7 operating system as a minimum.

D. Laptop computer Hardware - Communications

1. The new personal computers shall provide a minimum of two communication ports, one EIA-232C for local direct connect communications and one for remote dial-up communications. All communication ports shall be bidirectional data communicators.
2. Storage of software programs and communication logic shall be maintained without battery backed assistance.

E. Server Software

1. Server software shall take advantage of daily energy management report generation capability of the Global Control Panel (GCP) and all remote DDC controllers. The host computer shall automatically poll direct or remotely connected sites, gather the data, archive it and generate daily, weekly, monthly and yearly summaries as needed.
2. The host software shall permit acquisition and long term storage of unlimited independent trend logs. Trends shall be operated by the host directly or automatically uploaded from the GCP or remote DDC controllers at user specified intervals. Trend data shall be graphically represented using a dynamic process graphics report generator in a bar chart or line format including HTML, XML, PlainText, or HTTP formats.
3. Host software will contain alarm and exception processing systems. Events including point alarm, point faults, device diagnostics, maintenance time reminders, actual control programs and log on/off shall be recorded in the system status log. The System Status log shall define automatically generated exception reports based on user selectable criteria such as point type, operator, time and date of occurrence, etc. The program shall prioritize alarms for display with the most critical alarm first. An operator shall also be able to user define individual alarms to interrupt a user and display the system status log.
4. Provide icon selection of users programs such as database programming and monitoring. Provide menus with highlighted active commands, context commands descriptions and help files. A standard mouse interface and normal keyboard operation shall access all programs. Provide continuous display of system status, and text monitoring screens with highlighted alarm conditions and report generation.
5. Any action taken by an operator shall be logged to the systems status log to render an audit trail of operator actions. User access definitions shall be completely definable and modifiable by the system's manager.
6. The Graphical User Interface (GUI) shall run on Microsoft Windows 7 or most recent.
7. The GUI shall employ standard browsers including Windows Explorer and Firefox. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
8. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

a. Minimum Required Graphics:
    1) All setpoints shall be shown on the respected graphic page for each piece of equipment. All setpoints shall be adjustable and acceptable range of adjustment shall be noted in as-built sequence of operation.
    2) Home Screen with background image of school building or school logo and include following:
        (a) Information on current weather conditions
        (b) Link to building floor plan
        (c) Link to each individual air handling unit screen.
        (d) Link to chilled water plant screen.
        (e) Link to heating water plant screen.
        (f) Link to alarms page
        (g) Link to schedules page
        (h) Snow Day Schedule Button.
    3) Floor Plan: Overall floor plan shall be provided with units broke out in different colors. Link to each individual enlarged unit plan. Enlarged Unit plans shall contain:Unit shall Color graphic floor plan and zone floorplans showing all space temperatures, space CO2 levels and humidity levels where indicated on tempeature control drawings.
        (a) Floor plan showing all spaces with room numbers matching owner's final room number designations.
        (b) Temperature of each space. Either space or text shall change color based on deviation away from setpoint. Space or text shall change to blue if room below setpoint by 2 F (adj) and change to red if above 2 F (adj) setpoint. Text to be green for space setpoint met.
        (c) Show space humidity at locations of space humidity sensors.
        (d) Link back to overall floor plan.
        (e) Link to equipment page serving the room by clicking on the individual space.
        (f) Link to alarm page.
    4) Space Equipment Screen: Screen showing the individual equipment serving the space. Information on screen shall include:
        (a) Graphic of equipment including heating / cooling coils, valves, fans, and dampers. Graphics shall be dynamic.
        (b) Heating and Cooling Valve Position. If valve is a three-way valve, graphic to represent three way valve.
        (c) Fan operation including fan speed if variable speed.
        (d) Damper Positions.
        (e) Primary airflow value. Also minimum and maximum airflow settings.
        (f) Discharge air temperature.
        (g) Current space temperature, space setpoint, and setback temperature setpoints
        (h) Override button with override temperature
        (i) Current CO2 level (if specified), high and low level CO2 setpoints
        (j) Link to associated air handling unit.
        (k) Link back to overall floor plan screen.
        (l) Link to alarm screen.
    5) Air Handling Unit Screen:
        (a) Graphic of equipment including heating / cooling coils, valves, dampers, fans, filters, airflow stations and other sensors. Graphic shall be dynamic

(b) Heating and Cooling Valve Position. If valve is a three-way valve, graphic to represent three way valve.
(c) Fan operation including fan speed if variable speed.
(d) Provide a link to VFD screen. On VFD screen provide in a table format all information from VFD.
(e) Damper Positions.
(f) Energy Recovery wheel status
(g) Airflow values and temperature values as shown on temperature control drawing schematics.
(h) If air handling unit is set up as a VAV air handling unit, include the following information:
    (1) Supply air temperature
    (2) Supply air temperature setpoint
    (3) Supply air static pressure
    (4) Supply air fan static pressure setpoint.
(i) If air handling unit serves a single zone, include the following information on the equipment screen:
    (1) Space Temperature
    (2) Space Temperature setpoint.
    (3) Unoccupied space temperature and humdity setpoints.
    (4) Space Humidity level.
    (5) Space Humidity setpoint.
    (6) Space CO2 level.
    (7) Space CO2 setpoint.
(j) Filter differential pressure. Include alarm if DP hits high limit.
(k) Link to associated chilled water plant.
(l) Link to associated heating water plant.
(m) Link to sequence of operation page.
(n) Link to alarm page.
(o) Link back to overall floor plan.

6) Heating Water Plant Screen:
(a) Graphic of plant including boilers, pumps, and piping between pumps and boilers. All graphics shall be dynamic.
(b) Boiler firing rate, status. Include a link to a seperate page for each boiler. This seperate page shall include all information received from the boiler. Refer to boiler specification section for list of minimum data.
(c) Pump operation including speed.
(d) Provide a link to VFD screen. On VFD screen provide in a table format all information from VFD.
(e) Heating water supply static pressure.
(f) Heating water supply static pressure setpoint.
(g) Heating water supply static pressure override.
(h) Heating water supply and return water temperatures as shown on the temperature control schematics.
(i) Flowrates (GPM) as shown on the temperature control schematic.
(j) Boiler alarms. Provide a link to the alarm page.
(k) Link to sequence of operation page.
(l) Link back to overall floor plan.

7) Miscellaneous Equipment

(a) Include status, on/off button where noted in the sequence of operation, space temperature, space temperature setpoint for:
(1) Exhaust fans
(2) Unit Ventilators
(3) cabinet heaters
(4) unit heaters
(5) Technology space cooling equipment.

8) Alarms Page
(a) The system will be provided with a dedicated alarm screen. This screen will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.
(b) All critical alarms shall be wired so that unit fans, pumps, etc. cannot be turned on in hand mode when safety device is tripped.
(c) All critical alarms as determined by the owner shall be sent ot email accounts, cell phones, and pagers via text messaging capabilities.

9) Schedules Page
(a) Provide calendars for all air handling equipment.

b. The sequence of operations shall be located as a pull down feature at each piece of equipment or provide a link to a pdf document of the sequence of operations.
c. Provide As-Built wiring diagrams complete with material part numbers.
d. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Dynamic temperature values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
e. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
f. Graphic screens shall contain objects for text, real-time values, animation, color spectrum objects or “thermo-graphics”, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
g. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
h. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
3) Snow Day Operation shall be set by clicking on a "Snow Day" button located on screen of graphics.
i. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
j. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

9. System Configuration: At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
a. Create, delete or modify control strategies.

b. Add/delete objects to the system.
c. Tune control loops through the adjustment of control loop parameters.
d. Enable or disable control strategies.
e. Generate hard copy records or control strategies on a printer.
f. Select points to be alarmable and define the alarm state.
g. Select points to be trended over a period of time and initiate the recording of values automatically.

10. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
11. Security: Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
12. System Diagnostics. The system shall automatically monitor the operation of all workstations, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

F. BACnet Advanced Operator WorkStation (B-AWS)
1. The operator workstation shall meet all the requirements of the operator workstation and server software sections above.
2. The B-AWS software shall comply with the minimum requirements of ANSI/ASHRAE Standard 135 Annex L for B-AWS and shall be certified and listed by the BACnet Testing Labratories (BTL) as a B-AWS prior to the bid date for this project.
3. Under the alternate bid, the temperature control system front-end (operator workstation/server software) is not required to have Tridium N4 framework.

2.14 BUILDING AUTOMATION EQUIPMENT

A. System Network Controller (SNC)
1. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
2. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.
3. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
4. The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.
5. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 Fox, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

6. The SNC shall employ a device count capacity license model that supports expansion capabilities.
7. The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:
    a. BACnet
    b. SNMP
8. The SNC shall be capable of executing application control programs to provide:
    a. Calendar functions.
    b. Scheduling.
    c. Trending.
    d. Alarm monitoring and routing.
    e. Time synchronization.
    f. Integration of BACnet controller data.
    g. Network management functions for all SNC, PEC and ASC based devices.
9. The SNC shall provide the following hardware features as a minimum:
    a. Two 10/100 Mbps Ethernet ports.
    b. Two Isolated RS-485 ports with biasing switches.
    c. 1 GB RAM
    d. 4 GB Flash Total Storage / 2 GB User Storage
    e. Wi-Fi (Client or WAP)
    f. USB Flash Drive
    g. High Speed Field Bus Expansion
    h. -20-60°C Ambient Operating Temperature
    i. Integrated 24 VAC/DC Global Power Supply
    j. MicroSD Memory Card Employing Encrypted Safe Boot Technology
10. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
11. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers
12. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
    a. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
        1) Alarm.
        2) Return to normal.
        3) To default.
    b. Alarms shall be annunciated in any of the following manners as defined by the user:
        1) Screen message text.
        2) Email of complete alarm message to multiple recipients.
    c. The following shall be recorded by the SNC for each alarm (at a minimum):
        1) Time and date.
        2) Equipment (air handler #, access way, etc.).
        3) Acknowledge time, date, and user who issued acknowledgement
13. Programming software and all controller "Setup Wizards" shall be embedded into the SNC.
14. The SNC shall support the following security functions.
    a. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
    b. Role-Based Access Control (RBAC) for managing user roles and permissions.
    c. Require users to use strong credentials.

d. Data in Motion and Sensitive Data at Rest be encrypted.
e. LDAP and Kerberos integration of access management

15. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
    a. Metadata: Descriptive tags to define the structure of properties.
    b. Tagging: Process to apply metadata to components
    c. Tag Dictionary
16. The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD…) shall have an associated template file for reuse on future project additions.
17. The SNC shall be provided with a 5 Year Software Maintenance license. Labor to implement not included.

B. Primary Controllers (Air Handling Units and Heating Water Plant)

1. Each primary controller shall be a dedicated, stand-alone, microprocessor-based DDC controller that is BACnet certified (B-BC / B-AAC) with sufficient capacity to handle all points and programming associated with the control sequences as specified. In addition, each controller shall have a minimum 15% spare point capacity. Primary controllers shall be capable of being mounted within the equipment housing and shall have the capability to be programmed on-line and/or off-line (simulation capability) as required to meet unique HVAC application needs as well as the various ASHRAE control cycles. Primary controllers shall be capable of communicating global and critical variables to other primary controllers residing on the same network without the intervention of a higher level controller (Peer to Peer communication).
2. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
3. All primary controllers shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the primary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.
4. Software incorporated into the controller shall include the following:
    a. Real time operating system software
    b. Real time clock/calendar and network time synchronization
    c. Primary control unit diagnostic software
    d. LAN/WAN communication software
    e. Alarm processing and buffer software
    f. Energy management software
    g. Data trending, reporting, and buffering software
    h. Input/output database (physical and virtual points)
5. Primary controller shall have expansion capability to support additional I/O requirements thru remote expansion input/output modules.
6. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.
    d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

7. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
8. An RJ-11 type connection serial port shall allow a local portable operator terminal to access all program blocks and attributes for complete programmability. The port shall also support complete up/downloading capability.
9. All input/output and control parameters may be utilized or shared throughout the network. All primary controllers shall be accessible throughout the network.

C. Secondary Controllers (cabinet heaters, unit ventilators, and miscellaneous equipment)
1. Each secondary controller shall be a stand-alone, microprocessor-based DDC controller that is BACnet certified (B-AAC / B-ASC) with sufficient capacity to handle all points associated with the control sequences as specified. Secondary controllers shall be capable of being programmed on-line and/or off-line (simulation capability) as required to meet the specific HVAC application needs as well as the various ASHRAE control cycles. Secondary controllers shall be capable of communicating with other secondary controllers through an interface or higher level controller.
2. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
3. Secondary controllers shall be microprocessor-based, programmable DDC controllers with all operating parameters, setpoints and schedules stored in memory which resides on the controller.
4. Software incorporated into the controller shall include the following:
    a. Real time operating system software
    b. Secondary control unit diagnostic software
    c. LAN/WAN communication software
    d. Control software applicable to the unit it serves that will support one mode of operation
    e. Input/output database (physical and virtual points) to support one mode of operation
5. The controller shall have digital inputs (DI), digital Triac outputs (DO), three analog outputs (AO), and universal inputs (UI).
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.
6. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
7. The controller platform shall have a standard HVAC application program(s) that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in the specification. The controller shall have the capability to communication thru read/write the following:
    a. Reset room setpoint
    b. Read/log/trend room temperature
    c. Override day or night operation
    d. Read the discharge air temperature at each terminal unit
    e. Room CO2 control.
    f. Assign daily occupied/unoccupied times
    g. Read terminal type i.e. fan powered, reheat, etc.
8. Should communications to the secondary controller fail in any manner, the controller will have its configuration in non volatile memory and shall maintain room setpoint.

2.15 TEMPERATURE CONTROL WIRING

A. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.

B. Control wiring shall meet the requirements of Article 725, Class 1, Class 2, Class 3 Remote-Control, signaling, and power-limited circuits of the NEC.

C. Control wiring shall be UL listed plenum rated cable or installed in conduit. Wiring shall be routed in conduit where exposed to occupied spaces and in mechanical rooms. Conduit shall be 1/2 inch minimum size and shall be furnished and installed under this section. Exposed wiring in occupied spaces and mechanical rooms will not be accepted.

D. Concealed wiring and wiring in non-plenum ceiling cavities, which is operating under 100 volts, may be open wired if in compliance with Article 725, NFPA-70 (NEC). Open wiring shall be secured with plastic tie wraps to the permanent building structure as approved by the Architect/Engineer.

E. Terminations shall be performed by the Temperature Control Contractor.

F. Wire and conduit not indicated on the Drawings or in the Specifications, but required by the controls supplier, shall be paid for by the Temperature Control Contractor. This includes power supply wiring which is not indicated in the Division 26 drawings but which is necessary for system operation.

G. Temperature control cable is to be properly supported per industry standards and practices. Cable tray shall not be used for installation of temperature control wiring.
   1. Bridle rings shall be used to support wiring in all return air plenums.

H. Temperature control wiring Color Identification Guide:
   1. Wiring between AHU equipment, pumps, chillers, and miscellaneous equipment shall be white.

I. Where required, ethernet network communication cable shall be minimum Category 5e in a plenum approved raceway or insulation.

J. Cable pathways must be supported by "J" hooks or an approved support for category cabling. "O" rings will not be acceptable. The distance between cabling supports shall not exceed 48". Control cabling shall be ran separately from data network cabling.

K. The Contractor shall be responsible for testing each cable "end-to-end" at Architect/Engineer direction and verifying, in writing, that the cabling is in proper working condition. The Contractor is required to test the cable after its installation and to provide Architect/Engineer with written and test equipment generated documentation verifying test results. Each test results shall be labeled as it is in the field with the serving room number, patch panel number/letter and patch panel port number.

L. Basic Link Testing
   1. Category 5e - Testing of all installed “Basic Links” shall be performed using a Level IIe hand-held tester with latest software version and performed to the latest revision of TIA/EIA TSB-67 and TSB95. All reports shall be recorded and presented to the CxA/Owner before acceptance.

M. Cable Separation from power wiring
   1. Between the cabling system and any fluorescent, neon, incandescent, or high intensity discharge lamp fixtures, the minimum distance shall be 6 inches.
   2. Cable may be installed closer to lighting and convenience outlet power cable (single phase, 120V, 20A maximum), in metal cable channels for limited distances if the following guidelines are observed:

a. Coincident (parallel) runs of no more than 15 feet are permissible if a one inch separation between the power cable and the cabling system cable is maintained by separators or suitable retention hardware. If necessary, the separation may be less than 1 inch for a run of up to 6 inches if no contact between the cabling system cable and the power cable occur.
b. Coincident runs of no more than 30 feet are permissible if a two inch separation is maintained. The separation may be less than 2 inches for a run of up to 12 inches, if no contact occurs between the cabling system cable and the power cable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

E. Ensure installation of components is complementary to installation of similar components.

F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Existing controls and components fourn to be unnecessary shall be removed and disposed of off site. Refer to control drawings schematics for components on existing equipment that is to be new and what can be salvaged to remain.

B. Install in accordance with manufacturer's instructions.

C. Airflow measurement sensing elements location and sizing of airflow measurement elements shall be confirmed in the field by local factory representative. Velocity calculation and corresponding differential pressure calculations will be calculated accordingly.

D. Installing contractor shall remote mount the transducer in an acceptable location and provide all pneumatic tubing & wiring required between the transducer and airflow sensors.

E. Wiring for differential pressure sensors that control heating and chilled water pump operation shall be wired back directly to the chilled water or heating water plant controller. Wiring to nearest controller will not be permitted.

F. Check and verify location of thermostats with plans and room details before installation. Locate bottom at 44 inches above floor. Align with lighting switches.

G. Mount freeze protection thermostats using flanges and element holders.

H. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

I. Provide separable sockets for liquids and flanges for air bulb elements.

J. Provide guards on thermostats entrances, public areas, and where indicated.

K. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

L. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.

M. Install damper motors on outside of duct in conditioned spaces. Do not install motors in locations at outdoor temperatures.

N. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

O. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

P. Temperature control contractor shall make themselves familiar with the commissioning specification and provide all items for the commissioning agents use as noted.

3.03 SEQUENCE OF OPERATION

A. Refer to Specification Section 23 0993 for all equipment sequences of operation.

3.04 OCCUPIED / UNOCCUPIED ZONES

A. Manual Overrides:
   1. Provide manual, push button overrides as a part of each room temperature sensor. Pressing of override button will place zone on which sensor is located into a programmed override that is adjustable through the software.
   2. All zones shall include computer controlled overrides.

B. Refer to specification section 23 0993 for specified zones.

3.05 GUARANTEE

A. It is intended that the Temperature Control Contractor include as part of his bid two (2) year full service warranty. All labor and material shall be guaranteed against defects in workmanship for two (2) year period from the date of Substantial Completion and acceptance by the Owner. Any material proving defective shall be repaired or replaced during that period. This shall not, however, apply to material that has been damaged due to willful negligence.

B. The Contractor will provide hardware and software support during the two year guarantee after the date of acceptance. Hardware support includes replacing of any major or minor components, relays, sensors, etc., that fail to operate properly. Software support includes upgrading of software during warranty period such that system is loaded with latest available revision at end of warranty period.

C. Software support during the two year warranty shall include any programming changes to correct control operation resulting in alarms. All changes shall be cooresponded with the design engineer and owner.

D. Support is also defined to include Owner personnel training needed to operate the system effectively as outlined in this Specification. Explicitly included is the training needed to analyze a building's operation with a view to minimizing energy costs.

3.06 TRAINING

A. The Temperature Control Contractor shall, during the one-year guarantee period, provide no less than (4) 4-hour training sessions to be held at the building site after system is in full operation. A 4 hour training session shall be given quarterly during the first 12 months of operation to familiarize maintenance personnel on the operation of the mechanical and control systems through the host computer.

B. Training shall include a hands on process to get owner involved with making changes, setting schedules, monitoring and acknowleding alarms, setting up trends, and monitoring trends.

C. All training shall be video-taped by the control Contractor. Two copies shall be turned over to the owner's maintenance staff.

D. No training shall take place until system acceptance by the owner and engineer. For system acceptance, the BAS contractor shall issue a report that the system is complete, has been adjusted, and is operating on accordance with the project specifications. Any deviations from the specified settings or operations that were necessary shall be indicated in the report.

3.07 SERVICE CHECKS

A. Prior to final inspection, this Contractor shall perform the following service work, including, but not limited to, the following items:
   1. Check and oil electric motors furnished under control system.
   2. Lubricate damper bearings as required.
   3. Check damper travel, adjust and tighten set screws.
   4. Lubricate valve stems, as required, check packing; repair as required.
   5. Calibration of instruments.
   6. Check and verify circuitry.
   7. Calibrate and checkout controllers, fusing, etc.
   8. Test and debug microprocessor and software.
   9. Startup and test operation of variable frequency drive with factory authorized personnel.

3.08 FINAL COMPLETION

A. When the work is completed, and at a time directed by the Owner or the Architect/Engineer, the Contractor shall carefully adjust all parts of the equipment and systems. This includes adjustment of automatic controls and safety devices, proper setting of adjustable devices, dampers and valves, and other necessary operations so the systems are fully operable and automatic in operation. Upon completion of the Work, notify the Owner, and/or Architect/Engineer that system is ready for final tests and inspection.

B. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Architect/Engineer, that his Work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.

C. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Architect/Engineer, that subsystems operate as a coordinated and properly functioning, integrated system.

D. The Contractor shall furnish labor, provide adjustments and incidentals necessary to obtain the desired and intended results.

E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the Owner at the conclusion of the first year warranty.

F. The contractor shall provide a list of all devices and their addresses to the owner. This shall be included in the O&M manual.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sequence of operation for:
   1. Rooftop Air Handling Unit

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instruments and Control Elements.

B. Section 23 09 23 - Direct-Digital Control System for HVAC.

1.03 SYSTEM DESCRIPTION

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation shall meet the requirements of ASHRAE Standard 90.1-2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Temperature Control Contractor shall coordinate a meeting with the Engineer before submitting control sequence to ensure all sequences are understood and to address areas of concern. Sequence of Operation will not be reviewed until this meeting has taken place.

C. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.

D. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.
   4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

E. Points List: Submit list of all control points indicating at least the following for each point. The point names used in the field must match the point names served up by the control system.
   1. Name of controlled system.
   2. Point abbreviation.
   3. Point description; such as dry bulb temperature, airflow, etc.
   4. Display unit.
   5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
   6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
   7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
   8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

F. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.05 QUALITY ASSURANCE

A. The installing contractor shall be an experienced, licensed dealer for the BAS system specified. Contractor to have a minimum of five years experience in both installation and maintenance of the units required for this project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXISTING BAS INTEGRATION

A. It is the intent of the project to integrate the new rooftop air handling units to the existing BAS system within the school. The school recently implemented a new BAS system in the Summer of 2025 with Prime Building Controls based in Columbus, Ohio. All new equipment must integrate into the Prime Building Controls interface. The Division 23 contractor is responsible for coordinating work with Prime Building Controls for integration.

3.02 ROOFTOP AIR HANDLING UNITS (RTU-A101 & RTU-A102)

A. Provide a microprocessor based direct digital control system that shall provide the following:
   1. Direct Digital Controller interface
   2. Occupied-unoccupied control.
   3. Necessary operating interlocks.

B. The packaged rooftop units shall be completely factory wired with necessary controls. The control sequence shall contain algorithms that will make all heating, cooling, and ventilation decisions in response to signals from BAS control panel. The control algorithm shall maintain accurate temperature control and mimize drift from setpoint. The control microprocessor shall provide anti-short cycle timing and time delay between compressor.

C. Heating Warm-Up
   1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to warm up the space as a function of both internal and external air temperatures. Incorporate either a self-learning or adaptive feature.
   2. The air handling unit supply fan shall be indexed to run at the start of heating warmup cycle.
   3. The outside air damper shall remain closed during heating warm-up cycle.
   4. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the minimum ventilation air as denoted on the drawings.

D. Cooling Pull-Down
   1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to warm up the space as a function of both internal and external air temperatures. Incorporate either a self-learning or adaptive feature.
   2. The air handling unit supply fan shall be indexed to run at the start of cooling pull-down cycle.
   3. Outside air shall be used during the pull-down cycle if the outside air temperature is below 65 degrees F. (adj.). Above 65 degrees F outdoor air temperature, the outside air damper shall remain closed and the DX cooling to be indexed open until the temperature is 75 degrees F (adj.).

4. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the minimum ventilation air as denoted on the drawings.

E. Occupied Cycle
   1. The outside air damper shall be modulated open. The outside air damper and return air damper shall be modulated to maintain the minimum outdoor air amount per the air handling unit schedule.
   2. A carbon dioxide sensor located in the gym space shall send a signal to the direct digital controller, with the carbon dioxide level determining the outside ventilation air required. The outside air damper shall be set at it's minimum position to bring in the minimum ventilation air amount as scheduled whenever the space CO2 levels are below 800 ppm (low level CO2 setpoint). The outside air damper shall modulate in a linear path between the minimum CO2 concentration of 800 ppm (adj.) and maximum CO2 level of 2400 ppm (adj.).
   3. Gas-Fired Heating: The controller will measure the zone temperature and stage natural gas burners to maintain the zone temperature setpoint. The heating will be enabled whenever:
      a. Outside air temperature is less than 65 deg F (adj.).
      b. AND the supply fan status is on.
      c. AND the cooling is not active.
   4. Cooling Mode: The controller will meaure the zone temperature and stage DX cooling to maintain the zone temperature setpoint. The cooling will be enabled whenever:
      a. Outside air temeprature is greater than 60 deg F (adj.).
      b. AND the economizer is disabled or fully open.
      c. AND the supply fan status is on.
      d. AND the heating is not active.
   5. Deadband Mode:
      a. When the space temperature is between the heating and cooling setpoints, the supply fan shall operate at minimum fan speed.

F. Dehumidification Mode:
   1. A humidity sensor located in the gym space shall monitor space humidity. Whenever the space humidity level rises above 60% (adj.), DX cooling to be staged on as needed to bring the space humidity back to setpoint. Hot Gas Reheat and Gas-Fired Heating to be enabled in order to maintain zone temperature at setpoint.
   2. No mechanical cooling shall be available until the outside air temperature is above 50 deg F (adj).

G. Unoccupied Cycle:
   1. The direct digital controller shall automatically program the unit to the unoccupied control mode.
   2. The unit may be manually placed into full occupied cycle during unoccupied time through the DDC controller for a pre-programmed period of time.
   3. The outside air damper shall be closed and the return air damper modulated open.
   4. Supply fan shall be indexed to operate and the heating sequece to be indexed whenever a space requires heating to maintain a minimum space unoccupied temperature of 65 degrees F (adj.)
   5. Mechanical cooling shall be locked out.

H. Safeties

1. Provide a software reset safety high limit in the discharge air duct to stop the supply fan if discharge static pressure goes above 6 inches W.C. (adj.). System shall be capable of being reset through software at the temperature control computer.
2. Provide a software reset safety low limit thermostat downstream of heating coil set to close the outside air dampers, open the heating coil valve full, stop the supply fan if the air temperature drops below 40 degrees (adj.). System shall be capable of being reset through software at the temperature control computer.
3. Provide differential pressure sensing across air filters and send alarm to BAS panel requesting filter change. Include independent alarm for each filter bank at each air handling unit. Pre-filters and final filters shall be monitored independently with a total of two alarms per air handling unit. Alarms and setpoints shall be capable of being reset through software at the temperature control computer.The system provided must be capable of manually positioning all damper operators, and the heating valve actuator if all levels of DDC control fail.
4. A fan proving device will indicate the fan status for each fan and send an alarm to the central BAS panel indicating fan failure.
5. All dampers internal to the air handling units shall be factory installed in the air handler. All actuators and control wiring shall be installed by the temperature control contractor. Refer to drawings for damper locations.
6. All safeties to be wired in such a way that the unit fans cannot be turned on in hand on mode whenever any safeties are tripped.
7. Smoke Detector: The unit will shut down, close outside air dampers, disable heating and cooling, and generate an alarm when smoke is detected in the unit.
8. Carbon Monoxide Detector: The unit will shut down, close outside air dampers, disable heating and cooling, and generate an alarm when carbon monoxide is detected in the space

3.03 ROOFTOP AIR HANDLING UNITS (RTU-D103)

A. Provide a microprocessor based direct digital control system that shall provide the following:
   1. Direct Digital Controller interface.
   2. Occupied-unoccupied control.
   3. Necessary operating interlocks.

B. The packaged rooftop units shall be completely factory wired with necessary controls. The control sequence shall contain algorithms that will make all heating, cooling, and ventilation decisions in response to signals from BAS control panel. The control algorithm shall maintain accurate temperature control and mimize drift from setpoint. The control microprocessor shall provide anti-short cycle timing and time delay between compressor.

C. Heating Warm-Up
   1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to warm up the space as a function of both internal and external air temperatures. Incorporate either a self-learning or adaptive feature.
   2. The air handling unit supply fan shall be indexed to run at the start of heating warmup cycle.
   3. The outside air damper shall remain closed during heating warm-up cycle.
   4. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the minimum ventilation air as denoted on the drawings.

D. Cooling Pull-Down

1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to warm up the space as a function of both internal and external air temperatures. Incorporate either a self-learning or adaptive feature.
2. The air handling unit supply fan shall be indexed to run at the start of cooling pull-down cycle.
3. Outside air shall be used during the pull-down cycle if the outside air temperature is below 65 degrees F. (adj.). Above 65 degrees F outdoor air temperature, the outside air damper shall remain closed and the DX cooling to be indexed open until the temperature is 75 degrees F (adj.).
4. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the minimum ventilation air as denoted on the drawings.

E. Occupied Cycle
1. The outside air damper shall be modulated open. The outside air damper and return air damper shall be modulated to maintain the minimum outdoor air amount per the air handling unit schedule.
2. A carbon dioxide sensor located in the gym space shall send a signal to the direct digital controller, with the carbon dioxide level determining the outside ventilation air required. The outside air damper shall be set at it's minimum position to bring in the minimum ventilation air amount as scheduled whenever the space CO2 levels are below 800 ppm (low level CO2 setpoint). The outside air damper shall modulate in a linear path between the minimum CO2 concentration of 800 ppm (adj.) and maximum CO2 level of 2400 ppm (adj.).
3. Heat Pump Heating: The controller will measure the zone temperature and stage heat pump heating to maintain the zone temperature setpoint. The heating will be enabled whenever:
    a. Outside air temperature is less than 65 deg F (adj.).
    b. AND the supply fan status is on.
    c. AND the cooling is not active.
4. Hot Water Heating:The controller will measure the zone temperature and stage heat pump heating to maintain the zone temperature setpoint. The heating will be enabled whenever:
    a. Outside air temperature is less than 65 deg F (adj.).
    b. AND the Heat Pump Heating is on.
    c. AND space temperature is not satisfied after 15 minutes.
    d. OR Heat Pump signals failure or off due to outdoor air temperature lockout
5. Cooling Mode: The controller will meaure the zone temperature and stage DX cooling to maintain the zone temperature setpoint. The cooling will be enabled whenever:
    a. Outside air temeprature is greater than 60 deg F (adj.).
    b. AND the economizer is disabled or fully open.
    c. AND the supply fan status is on.
    d. AND the heating is not active.
6. Deadband Mode:
    a. When the space temperature is between the heating and cooling setpoints, the supply fan shall operate at minimum fan speed.

F. Dehumidification Mode:
1. A humidity sensor located in the gym space shall monitor space humidity. Whenever the space humidity level rises above 60% (adj.), DX cooling to be staged on as needed to bring the space humidity back to setpoint. Hot Gas Reheat and Heat Pump Heating and Hot Water Heating will be enabled in order to maintain zone temperature at setpoint.

2. No mechanical cooling shall be available until the outside air temperature is above 50 deg F (adj).

G. Unoccupied Cycle
1. The direct digital controller shall automatically program the unit to the unoccupied control mode.
2. The unit may be manually placed into full occupied cycle during unoccupied time through the DDC controller for a pre-programmed period of time.
3. The outside air damper shall be closed and the return air damper modulated open.
4. Supply fan shall be indexed to operate and the heating sequece to be indexed whenever a space requires heating to maintain a minimum space unoccupied temperature of 65 degrees F (adj.)
5. Mechanical cooling shall be locked out.

H. Safeties
1. Provide a software reset safety high limit in the discharge air duct to stop the supply fan if discharge static pressure goes above 6 inches W.C. (adj.). System shall be capable of being reset through software at the temperature control computer.
2. Provide a software reset safety low limit thermostat downstream of heating coil set to close the outside air dampers, open the heating coil valve full, stop the supply fan if the air temperature drops below 40 degrees (adj.). System shall be capable of being reset through software at the temperature control computer.
3. The system provided must be capable of manually positioning all damper operators, and the heating valve actuator if all levels of DDC control fail.
4. A fan proving device will indicate the fan status for each fan and send an alarm to the central BAS panel indicating fan failure.
5. All dampers internal to the air handling units shall be factory installed in the air handler. All actuators and control wiring shall be installed by the temperature control contractor. Refer to drawings for damper locations.
6. All safeties to be wired in such a way that the unit fans cannot be turned on in hand on mode whenever any safeties are tripped.
7. Smoke Detector: The unit will shut down, close outside air dampers, disable heating and cooling, and generate an alarm when smoke is detected in the unit.

3.04 SNOW DAY

A. A "Snow Day" routine shall be provided to return all systems to unoccupied mode upon indication by system operator.

3.05 FIRE ALARM

A. Coordinate with Division 28 and provide necessary contacts to shut down all mechanical equipment during a fire alarm. The system shall be capable of restarting equipment globally upon a "no alarm signal" from the fire alarm panel.

3.06 CRITICAL ALARMS

A. Critical alarms shall dial personal cell telephones, pagers, or home telephones and send email messages to selected school district employees.

B. The following Alarms shall be considered critical alarms:
1. Heat Pump Failure
2. Any space temperature dropping below 40 degrees F (adj.)
3. Any additional alarms deemed critical by the school district and/or the Architect/Engineer.

3.07 DAY/NIGHT ZONES

A. The following shall be the accepted zone control. Zone control shall include all air handling units, variable-volume fan-powered terminals, unit ventilators, fan coil units, radiant ceiling panels, and exhaust fans. All zones to include capabilities through the direct digital controller for override setting to full occupied cycle during unoccupied cycle.

B. Zones:
   1. Zone 1 - High School Gymnasium
   2. Zone 2 - Middle School Gymnasium

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Roof hoods.

1.02 RELATED REQUIREMENTS

A. Refer to Section 01 6000 - Product Requirements

B. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

C. NFPA 90A for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger-HVAC: www.krueger-hvac.com/#sle.

B. Price Industries: www.price-hvac.com/#sle.

C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DUCT SUPPLY REGISTERS/GRILLES: TYPE DD

A. Type: Direct spiral duct-mounted supply grilles. Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection. Front blades parallel to short dimension. Rear blades parallel to long dimension. Provide air scoop.

B. Frame: Curved border to match duct diameter, 1-1/4 inch margin with countersunk screw mounting and foam gasket for air tight seal.

C. Prime coat for for final painting in field by general contractor. Color by architect.

D. Fabrication: Aluminum extrusions with factory prime coat finish.

E. Blades: Heavy duty aluminum, 3/4" spacing, individually adjustable without loosening or rattling.

F. Damper: Air scoop damper/extractor shall be heavy duty aluminum, integral, operable from the face with a screw driver.

G. Design based on Titus moel S300FS, Krueger: Model DMGDR, Price: Model SDGE

2.03 HEAVY DUTY WALL GRILLE: TYPE HDG

A. Type: Steel construction with fixed blades with 1/2 inch spacing and 38 degree deflection. Blades parallel to long dimension.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel construction with 16 gage frame and 14 gage blades, with factory off-white enamel finish. Corners shall be welded with full penetration resistance welds with a reinforcing patch for extra strength. Bars shall be reinforced by perpendicular, steel support bars spaced on 6-inch maximum centers.

D. Prime coat for side wall installation for final painting in field to match wall color. Final painting by general contractor.

E. Design based on Titus model 33RL. Krueger: Model S48(H/V), Price: Model 91, Tuttle & Bailey model T116H-1.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers. If dampers are specified and provided as part of the diffuser, or grille and register assembly balancing dampers are not required.

E. Refer to drawings for diffuser sizes, air flow patterns, etc.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

END OF SECTION

SECTION 23 74 16
PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged, intermediate-capacity, rooftop air-conditioning units.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.

B. Section 23 05 48 - Vibration and Seismic Controls.

C. Section 23 09 13 - Instruments and Control Elements: Control components, time clocks.

D. Section 23 09 13 - Instruments and Control Elements: Installation of thermostats and other control components.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.

C. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

E. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Filters: One set for each unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin Applied

B. Carrier Corporation; www.commercial.carrier.com/#sle.

C. Johnson Controls International, PLC; www.johnsoncontrols.com/#sle.

D. Rheem Manufacturing Company Inc; www.rheem.com/#sle.

E. Trane, a brand of Ingersoll Rand; www.trane.com/#sle.

F. AAON Inc

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner or hydronic heating coils and electric heat pump refrigeration that are 7.5 tons to 25 tons in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, gas burners or hydronic and heat pump heating elements , controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: R32 or R454B
   1. Factory installed A2L leak detection system required for A2L refrigerants.

D. Electrical Characteristics:
   1. 460 volts, three phase, 60 Hz.

E. Disconnect Switch: A single disconnect switch provided and installed in the field by Division 26 contractor. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle. See Section 26 05 83.

F. Additional Requirements:
   1. The complete unint shall be cETLus listed.
   2. The unit shall be ASHRAE 90.1-2019 compliant and labeled.
   3. Unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with refrigerant and oil.
   4. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

5. Unit shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
6. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled MOCP, kW, and HP are maximum accpeted values that allow scheduled capactiy to be met.
7. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 CASING

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

2.04 FANS

2.05 BURNERS

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

2.06 HOT WATER HEATING COIL

A. Controls: Start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation.

2.07 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.08 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.09 COMPRESSORS

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

B. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

2.10 ROOF CURBS

A. Roof Mounting Curb: 14 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

END OF SECTION

SECTION 26 01 01
GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

B. Refer to Section 01 11 00 - Summary of Work.

C. Refer to Division 23 Mechanical Specifications and to the requirements stated therein applicable to the Electrical Work, where coordination of trades is covered.

D. The requirements of this Section shall apply to Work for Sections listed under Division 26, Electrical.

1.02 SUMMARY

A. When equipment furnished for or by the Owner is indicated on the Drawings or specified, this Contractor shall provide the proper size switches, conduit, wires, boxes, and fittings that may be required; and make connections complete. This Contractor shall verify exact requirements and locations before installation.
   1. Boxes, raceways, fittings and the like required by this contractor or any subcontractor hired by this contractor shall be coordinated by this contractor prior to footer, floor, wall, etc. types of construction for correct size

B. If the equipment, other than that which the Drawings were designed around, does not properly adapt itself to the space allotted or lend itself accessible for repair and maintenance, the Contractor shall be responsible to provide additional access panels, pipe, fittings, materials, and labor, to achieve the same end results.

C. Electrical support from bar joists shall be allowed only at panel points in top of bottom cords.
   1. Loading shall not exceed 5 pounds/S.F. or 100 pounds per panel point applied at the panel point.
   2. If support must occur between panel points, then threaded rods shall be dropped from both panel points, an adequate angle attached to both, and then the support attached to the angle as required.
   3. Suspension wires, straps, and chains such as those used to support electrical fixtures or equipment shall not be attached to or through steel roof decks.

D. The Contractor shall take field measurements necessary for his Work and shall be responsible for the accurate location and size of openings, recesses, slots, ferrules, and the like.

E. The Contractor shall be required to cooperate with "Other Trades" and other Contractors in the coordination of his Work to avoid interferences with installations by other trades and Contractors.

F. Should structural difficulties prevent the setting of cabinets or running of conduits, at points shown on Drawings, necessary minor deviations therefrom, as determined by the Architect/Engineer, may be permitted and shall be made without additional costs.

G. Extra costs which might result from deviations from the Drawings, so as to avoid interferences, shall be considered a "Job Condition" and no additional compensation will be considered applicable. In the event that such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur during the course of construction shall be brought to the

immediate attention of the Architect/Engineer, and his decision, confirmed in writing, shall be final.

H. Installation of surface mounted trough type raceway above or below switchgear, distribution panels, and/or panelboards shall be approved by engineer prior to installation.

1.03 REFERENCES

A. Work shall be in complete accordance with codes, rules, ordinances, regulations of authorities, bodies, associations, and governments, having proper and legal jurisdiction. Specifically, the following requirements shall be met in their entirety.
   1. State and Local Rules, Regulations, Codes, Statutes, and Ordinances
   2. National Fire Protection Association applicable requirements
   3. National Board of Fire Protection
   4. National Electrical Code applicable requirements
   5. Other Codes and Standards as specifically noted in each Section of the Specifications

B. Electrical equipment shall be Underwriter's approved; also, shall meet requirements established by NEC, NEMA, and ANSI and as specified hereinafter.

C. Abbreviations of authorities used in these Specifications:
   1. NEC National Electrical Code Latest Edition adopted by the National Fire Protection Association
   2. NEMA National Electrical Manufacturers Association
   3. OSHA Occupational Safety and Health Act
   4. IES Illuminating Engineering Society Standards
   5. IPCEA Insulated Power Cable Engineers Association
   6. ANSI American National Standards Institute, Inc.
   7. FCC Federal Communications Commission
   8. EIA Electronic Industries Association
   9. NAB National Association of Broadcasters
   10. NAEB National Association of Educational Broadcasters
   11. CBM Certified Ballasts Manufacturers
   12. ITL Independent Testing Laboratories
   13. ETL Electrical Testing Laboratories
   14. UL Underwriters Laboratories
   15. DLC Design Light Consortium
   16. NICET National Institute for Certification in Engineering Technologies

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Submit shop drawings and illustrations in accordance with requirements of Section 01 30 00 - Administrative Requirements.

C. Shop Drawings (By Contractor)
   1. Where limited space is available due to the nature of the Work, the requirements for shop and working drawings will apply and the Contractor is required to prepare complete shop drawings showing the exact disposition of apparatus, equipment, conduit, and the like, and its relation to the building so there will be no irregularities or interferences on this account. Shop drawings shall be prepared after coordination with other Contractors and other trades.
   2. Shop drawings will not be required to be submitted for review by the Architect/Engineer, unless expressly required herein, but may be submitted when not expressly required, at the option of the Contractor.

PART 2 EXECUTION

2.01 EXPLANATION AND PRECEDENCE OF DRAWINGS

A. For purpose of clearness and legibility, the Electrical "E" drawings are essentially diagrammatic and, although size and location of equipment are closely drawn to scale whenever possible, each Contractor shall make use of the data in all of the Contract Documents and shall verify this information at the building site.

B. The Drawings indicate required size and points of termination of wiring and other related items and they may suggest proper routes for such items to conform to structure, avoid obstructions, and preserve clearances. It is not intended that Drawings indicate every necessary offset, and it shall be the Work of the Contractor to install each item in a manner as to conform to structure, avoid obstructions, preserve headroom, and keep opening and passageways clear, without further instructions or costs to the Owner.

C. It is intended that apparatus be located symmetrical with architectural elements and shall be installed at exact height and location stipulated.

D. The Contractor shall fully inform himself regarding peculiarities and limitations of the spaces available for the installation of work and materials provided under his Contract. He shall exercise due and particular caution to determine that parts of his work are made quickly and easily accessible.

E. The Contractor shall carefully examine existing conditions, existing wiring, and other materials on the premises and compare the Drawings to the existing conditions. Variances and necessary changes shall be adjusted by appropriate modifications.

2.02 PERMITS, FEES, REGULATIONS, AND INSPECTIONS

A. Unless specifically noted otherwise, the Contractor shall arrange and pay for permits, fees, and inspections required in connection with his work.

B. Work shall be inspected by approved local and state inspection bureaus, Electrical Inspection Agency or authority, and electric utility.

C. Upon completion of the Work, the Contractor shall furnish to the Architect/Engineer a certification of inspection and approval from said Bureau or Agency before final payment on contract will be allowed.

2.03 HOISTS, RIGGING, TRANSPORTATION, AND SCAFFOLDING

A. The Contractor shall provide scaffolding, staging, cribbing, tackle, hoists, and rigging necessary for placing of his materials and equipment in their proper places in the Project. Temporary work shall be removed from the premises when its use is no longer required on the job.

B. The Contractor shall pay costs for transportation of materials and equipment to the jobsite and shall include such costs in his proposal.

C. Scaffolding and hoisting equipment shall comply with requirements of pertinent Federal, State, and Local Laws and Codes.

2.04 PROTECTION

A. In addition to other requirements of the Contract, the Contractor shall provide various types of protection as follows:
   1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and an oil proof floor cover.
   2. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
   3. Protect equipment, finished surfaces from paint droppings, insulation adhesive, and sizing droppings by use of drop cloths.

B. Switchboards, panelboards, light fixtures, and other electrical equipment shall be stored at the site with openings and bearings covered to exclude dust and moisture. Stockpiled pipe shall be placed on dunnage and protected from weather and from entry of foreign material.

C. The Contractor shall be responsible for the protection of finished work of other trades from damage or defacement by his operations and shall remedy such damage at his own expense.

2.05 EMERGENCY REPAIRS OR OPERATION

A. The Owner reserves the right to make emergency repairs and protection of the equipment and systems in operation without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibility during the bonding period.

2.06 PROVISIONS FOR LATER INSTALLATIONS

A. Where Work cannot be installed as the structure is being erected, the Contractor for such Work shall provide and arrange for the building-in of boxes, sleeves, inserts, fixtures, and devices necessary to permit installation of the omitted work during later phases of construction. The Contractor shall arrange for layout, chases, holes, and other openings which must be provided in masonry, concrete, and other work.

B. The Contractor shall be responsible for informing himself of the nature and arrangement of the materials and constructions to which his work attaches or passes through.

2.07 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEM

A. Provide a minimum of 8 hours total instruction to personnel selected by the Owner. Instructions shall include the following:
   1. Show equipment locations and explain how the various systems function, including: fire alarm system, power system and lighting controls.
   2. Refer to operating instructions manual for record and clarify.
   3. Coordinate written and verbal instructions so that each is understood by personnel.

B. Provide additional instructions to Owner's personnel as stipulated in other subsections of Division 26.

2.08 FINAL COMPLETION

A. Work shall be cleaned prior to Substantial Completion of the Work.

B. Retouch or repaint factory painted prime and finish coats, where scratched or damaged. Whenever retouching will not be satisfactory, in the opinion of the Architect/Engineer, the Architect/Engineer has the option to require complete repainting until the desired appearance is obtained.

C. Remove temporary wiring as soon as permanent system(s) or portions thereof are in operating condition and have been inspected and approved.

D. Lamps, fixtures, lenses, and reflectors shall be cleaned by the Contractor no sooner than 10 days prior to Substantial Completion of the Work.

E. The Contractor shall clean equipment; restore damaged materials; remove grease, oil, chemical, paint spots, and stains.

F. On completion of his Work, the Contractor shall remove and see that each of his subcontractors removes from the site tools, equipment, surplus materials, and rubbish pertaining to his operations, and pay costs for such removal and disposition.

2.09 CUTTING AND PATCHING

A. The Contractor shall do cutting and patching of building materials and piping, as required for the installation of his Work, but no structural members shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by the Architect.

B. Patching of and repair of damage to Work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place, or who causes damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay the costs of such patching or repair.

C. Conduits penetrating masonry walls shall not interrupt the vertical masonry wall reinforcing. Coordinate the location of reinforcement with Division 4. Wherever more than 2 conduits 2 inches or larger are to pass through a masonry wall in the same location or where conduits of any size in a row equals a length of 3 feet or greater, prior approval from the Architect shall be required before disturbing the wall. Wherever multiple conduits pass through masonry walls provide a minimum of 4 inches between adjacent penetrations.

D. The Contractor shall caulk around all conduit penetrations in non-fire rated wall with sealant.

2.10 GUARANTEE AND WARRANTY

A. The Contractor shall submit his and each equipment manufacturer's written certificates, warranting that each item of equipment furnished complies with the requirements of the Drawings and Specifications. The electrical system shall be warranted for one year from the date of substantial completion.

2.11 SUPERVISION AND COOPERATION

A. Work done by the Contractor under this Division shall include the services of an experienced superintendent, who shall be constantly in charge of the Work, together with the qualified journeymen, helpers, and laborers required to properly unload, install, connect, adjust, start and operate, and test the Work involved, including related equipment and materials furnished under other contracts or by the Owner.

2.12 MAINTENANCE AND OPERATING MANUALS AND INSTRUCTIONS

A. Comply with Section 01 78 00 - Closeout Submittals and the following:

B. Bind the written operating instructions, shop drawings, equipment catalog cuts, and manufacturer's instructions into the binder. Material to be assembled as follows:
   1. First Page - Title of Job, Fairbanks Local School District Board of Education, Building Name, Project Location Address 1 , Date of Submittal, Name of Contractor, and Garmann/Miller & Associates Inc. Emergency operating instructions and/or list of service organizations (including address and telephone numbers) capable of rendering emergency service on 24 hour calls.
   2. Second Page - Index
   3. Third Page - Introduction to first section containing a complete written description of the system.
   4. First Section - Written description of system contents, where actually located in building, how each part functions individually, and how system works as a whole. Conclude with a list of items requiring service and either state the service needed or refer to the manufacturer's data in the binder that described the proper service.
   5. Second Section - A copy of each approved shop drawing (clearly marked for item furnished), with an index at the beginning of the section. Provide a separate list of lighting fixtures used on the job; list shall include, but not be limited to: Plan type, manufacturer's catalog number, and voltage, number of lamps, lamp type, ballast catalog number, manufacturer's name and quantity (when required), catalog number and quantity of any replacement glass and plastic parts.
   6. Third Section - A copy of each manufacturer's operating instructions with an index at the beginning of the section.

7. Fourth Section - A list of equipment used on the job, Contractor's purchase order numbers, supplier's name and address.

C. One (1) electronic copy of the Operation and Maintenance Manuals shall be placed on a Thumb Drive, or other form of Mass Storage Device, for the Owners use. Files must be in a PDF format or format approved by the Owner.
   1. PDF shall be indexed/bookmarked to allow a quick search to the relevant material.

2.13 RECORD DRAWINGS

A. The Contractor shall keep a running record of each change and deviation from the Drawings. Records shall be kept clean and undamaged upon a set of drawings used for no other purpose. Upon completion of the Project, the Contractor shall submit to Garmann/Miller & Associates Inc. one complete set of Drawings which have been corrected to show deviations. With the submittal shall be 2 sets of prints made from the corrected Drawings for a total of 3 sets of record (as-built) drawings.

B. Record Drawings shall show:
   1. Size, type, and capacity of materials, devices, or pieces of equipment.
   2. Location of devices or pieces of equipment.
   3. Location of outlets or sources in building service systems.
   4. Routing of piping, conduit, ducts, or other building services.
   5. Actual circuit number.
   6. Building plan and devices shall be a scale of original construction documents.
   7. These drawings shall also record the location of concealed electric service, conduit, and other piping by indication of measured dimensions to each such line from readily identifiable and accessible walls or corners of the building.
   8. Record drawings must be complete and accurate with regard to concealed conduit, raceways, wiring, and like equipment or devices. Unless record drawings are sufficiently accurate to permit immediate location and identification of concealed work with a minimum of cutting, record drawings will be considered inadequate and the contract work deemed incomplete.

C. One (1) electronic copy of the Record Drawings shall be placed on a Thumb Drive, or other form of Mass Storage Device, for the Owners use. Files must be in a PDF format or format approved by the Owner.

END OF SECTION

SECTION 26 05 05
MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

B. Section 02 41 00 - Demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities and/or equipment.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Garmann/Miller & Associates Inc. before disturbing existing installation, mark on record drawings.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Coordinate panel outages with owner. It is the Electrical Contractor's responsibility to provide all site electrical disconnections required for demolition. Coordinate this work with the General Contractor.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

D. Existing Fire Alarm System: Maintain existing system in service throughout construction. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove any abandoned wire/cable found above ceiling that is not labeled for future use.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.02 SUMMARY

A. Provide a complete grounding system which shall be in accordance with the National Electric Code, State and Local Ordinances, and utility company requirements, and as indicated on the Drawings.

1.03 QUALITY ASSURANCE

A. Grounding shall be in accord with NEC, Article 250, and others which apply. Equipment shall be provided with a suitable ground lug.

B. UL 467

C. Bare solid copper conductors ASTM B3

D. Bare stranded copper conductors ASTM B8

E. Underground distribution components IEEE C2

PART 2 PRODUCTS

2.01 MATERIALS

A. Grounding connection "make-up" shall be with Erico Products Company "Cadweld", Burndy "Thermoweld", Harger "Ultraweld", or 3M of the type required at locations where a ground bus, lug, or connector is not stipulated.

B. Minimum 12 AWG 600V insulated copper equipment grounding conductor insulated with green colored insulation.

C. Stranded cable grounding electrode conductors.

D. Bare copper conductors.

PART 3 EXECUTION

3.01 INSTALLATION

A. The following requires permanent grounds: Conduits, and other conductor enclosures; control centers; noncurrent carrying metal parts of fixed equipment, such as motors, starter and controller cabinets, instrument cases, receptacles, equipment in hazardous locations; and others as indicated and/or required by NEC.

B. The grounding conductor shall be continuous wire and carried throughout the power system. Properly ground the neutral point of secondary transformers to conduit and to system ground wire. (Wire size per NEC). Grounding wire looping from transformer to transformer is not allowed.

C. Bond metallic conduit entering building switchboard.

D. System neutral conductor shall be identified throughout and shall be grounded at the point of service only.

E. Metallic conduit shall be electrically continuous throughout and be grounded (bonded) at the service entrance. Feeder conduits (one inch and larger) shall also be grounded at pull boxes,

junction boxes, cabinets, and terminal points using grounding knockouts and bushings, to the equipment grounding bar or lugs.

F. Cord connected appliance frames shall be grounded to the system grounding conductor and to the conduit system through a grounding conductor in the cord.

G. Flexible conduit connections to equipment and motors, and the like, shall have an equipment grounding conductor, size per NEC 250.

H. A green pigtail shall be installed from grounding slots of grounding outlets to system grounding conductor and to outlet box in each instance.

I. Green bonding jumper shall be installed in flexible metallic conduit, size per NEC 250.

J. Provide grounding of structural steel and ground field as denoted on the accompanying Drawings.

K. A separate equipment grounding conductor, sized in accord with NEC 250 shall be installed with each and every conduit and shall be attached to ground bars, lugs, equipment, frames, devices, pull boxes, junction boxes, outlet boxes, and the like.

L. Conduit is not an allowable grounding means.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

B. Conduit and equipment supports.

C. Anchors and fasteners.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.02 MANUFACTURERS

A. Threaded Rod Company

B. All-Ohio Threaded Rod Company

C. Precision Brand

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
1. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
2. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
3. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors or preset inserts.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.
8. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

J. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Obtain permission from Architect before drilling or cutting structural members.

K. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

L. Install surface-mounted cabinets and panelboards with minimum of four anchors.

M. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

N. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 05 33.13
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - GROUNDING AND BONDING.
   1. Includes additional requirements for fittings for grounding and bonding.

B. Section 26 05 29 - HANGERS AND SUPPORTS.

C. Section 26 05 53 - IDENTIFICATION.

D. Section 26 05 33.16 - BOXES.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

J. NFPA 70 - National Electrical Code; National Fire Protection Association; Most recent edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

O. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, fittings, and conduit bodies.

C. Project Record Documents: Accurately record actual routing of conduits larger than 1-1/2 inches.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Fittings for Grounding and Bonding: Also comply with Section 26 05 26 - GROUNDING AND BONDING.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Paint conduits that are exposed in open structure spaces. Color shall match nearest painted architectural element or as directed by owner.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

F. Conduit Size: Comply with NFPA 70.
   1. Minimum size: 1/2" unless otherwise specified.

G. Outdoor Locations Above Grade: Use rigid steel conduit.

H. Wet and Damp Locations: Use rigid steel or intermediate metal conduit.

I. Dry Locations:
   1. Concealed: Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
   2. Exposed: Use rigid steel conduit or intermediate metal conduit.

J. In addition to raceways for Division 26 work, the electrical contractor shall provide raceway systems for Division 28 - Electronic Safety and Security as coordinated with the system installer prior to installation. Systems shall be installed in conduit inside walls, and for spaces with open structures. Raceway for open spaces shall be routed from rough-in box, to an adjacent space with an accessible ceiling, or to the cable tray if tray is routed through the space.

2.02 MANUFACTURERS

A. Essex Group

B. Hubbell Power Systems

C. Hellermann Tyton

D. Wheatland Tube Company

E. Allied Tube and Conduit

F. Cantex Inc.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

C. Conduit Size: Comply with NFPA 70.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction with PVC jacket.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Thin wall conduit shall be Underwriter's approved electrical metallic tubing (EMT). EMT shall meet Federal Specification WW 806, latest edition.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. In finished rooms with open structure, conduit shall be concealed. If the structure is such that conduit cannot be concealed, the contractor shall review with the Architect and Engineer prior to installation.

B. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

C. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

D. Install nonmetallic conduit in accordance with manufacturer's instructions.

E. Arrange supports to prevent misalignment during wiring installation.

F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

G. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 1 additional conduit of similar size..

H. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 - HANGERS AND SUPPORTS.

I. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

J. Do not attach conduit to ceiling support wires.

K. Arrange conduit to maintain headroom and present neat appearance.

L. Route exposed conduit parallel and perpendicular to walls.

M. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

N. Maintain adequate clearance between conduit and piping.

O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

P. Cut conduit square using saw or pipecutter; de-burr cut ends.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.

S. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch size.

T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and expansion joints.

V. Provide suitable pull string in each empty conduit except sleeves and nipples.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Identify conduit under provisions of Section 26 05 53 - IDENTIFICATION.

END OF SECTION

SECTION 26 05 33.16
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - HANGERS AND SUPPORTS.

B. Section 26 27 26 - WIRING DEVICES:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements.

B. Project Record Documents: Record actual locations, mounting heights, and sizes of outlet, pull, and junction boxes on project record documents.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use raised covers suitable for the type of wall construction and device configuration where required.
4. Use shallow boxes where required by the type of wall construction.
5. Do not use "through-wall" boxes designed for access from both sides of wall.
6. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
7. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
8. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
9. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 MANUFACTURERS

A. Appleton Electric.

B. Arc-Co./Division of Arcade Technology: www.arc-co.com.

C. Unity Manufacturing: www.unitymfg.com.

D. Hubbell

E. Thomas and Betts

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.04 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
   3. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
   4. Cover Legend: "ELECTRIC".
   5. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.
   6. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Coordinate locations of outlets with other trades prior to rough-in.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Install boxes plumb and level.

F. Install boxes as required to preserve insulation integrity.

G. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

H. Close unused box openings.

I. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

J. Provide grounding and bonding in accordance with Section 26 05 26.

K. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

L. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

M. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 3 feet if required to accommodate intended purpose.

N. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

O. Maintain headroom and present neat mechanical appearance.

P. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

Q. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

R. Use flush mounting outlet box in finished areas.

S. Use adjustable steel channel fasteners for hung ceiling outlet box.

T. Do not fasten boxes to ceiling support wires.

U. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

V. Use gang box where more than one device is mounted together. Do not use sectional box.

W. Use gang box with plaster ring for single device outlets.

X. Use cast outlet box in exterior locations exposed to the weather and wet locations.

Y. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

A. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material prior to affixating cover plate.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 50
BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements are included as a part of this Section as though bound herein.

B. Refer to Section 01 2300 for Alternates that may affect the Work of this Section.

C. Refer to other Sections of Division 26 for additional detailed material and methods of Specifications.

1.02 SUMMARY

A. This Contractor shall install rough-in work pertaining to his trade for each item of equipment furnished under another Section of the Specifications or by Owner. The Contractor shall, before bidding the Project, verify exact rough-in requirements before installation with the Contractor, subcontractor, Owner, or supplier furnishing said equipment, who shall furnish dimensional Drawings accurately locating rough-in for his equipment.

B. The Contractor shall rough-in and connect equipment, appliances, and the like, requiring electric services.

C. Provide sleeves, raceways, conduit, conduit fittings, conductors, fuses, grounding equipment, devices, disconnects, starters, and protective systems required or denoted on Drawings.

1.03 SUBMITTALS

A. Comply with requirements of Section 01 3000 and Division 26 Sections.

1.04 QUALITY ASSURANCE

A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be approved by the Underwriters' Laboratories, Inc., if a standard has been established by that agency for the type of material.

B. Materials shall also comply with applicable standards of the National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, National Safety Code, and the American Institute of Electrical Engineers. Such standards are hereby made a part of these Specifications.

C. Work shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed. Methods and techniques of installation shall be subject to the approval of the Architect.

D. Materials of the same type or class shall be the product of one manufacturer. For example, panelboards shall be from one manufacturer, lighting switches from one manufacturer.

1.05 PROJECT CONDITIONS

A. The Contractor shall be responsible for the accurate location of his Work and for informing himself of the nature and arrangement of the materials, equipment, and construction to which his Work attaches or passes through.

B. In general, piping, conduits, and other work shall be concealed in walls and above ceilings, in utility of pipe spaces, in chases, in joist spaces, in tunnels, in equipment rooms, and the like, insofar as is practical; so that such work will not interfere with the proper coordinated installation work of other trades or Contractors.

C. In general, piping, conduits, and lines, except those below slabs on grade shall be installed parallel (or at right angles) to the building walls, and at such heights as not to obstruct portions of windows, doorways, stairways, pipe space, tunnel, or passageway, and properly concealed to not interfere with the proper coordinated installation of other trades or Contractors. Where interferences develop in the field, the Work shall be offset or routed as required to clear such interferences. Consult architectural, mechanical, electrical drawings, Contractors, and other details before installing work; and unless otherwise specified, ductwork installation shall take precedence over other crafts, such as piping and conduit as determined by the Architect/Engineer.

D. Materials installed shall be new and never before used.

E. The Contractor shall procure definite locations and connections before rough-in or installation. This Contractor shall then lay out his Work and be responsible for determining proper elevations, angles, measurements, and locations required for the installation of his Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide overcurrent protective devices in accordance with Article 240 of the National Electric Code.

B. The overcurrent protective devices must be capable of interrupting the amount of short circuit current available at their location as stated in the National Electric Code.

C. Overcurrent protective devices shall be so selected and coordinated to permit maximum continuity of service and comply with the National Electric Code.

PART 3 EXECUTION

3.01 DISPOSALS

A. Remove and properly dispose of debris, rubbish, and excavation spoils resulting from the Work, off the premises. Obtain necessary permits for dumping.

3.02 FOUNDATIONS AND ANCHOR BOLTS AND CURBS

A. The Contractor shall provide concrete pad foundations for floor mounted equipment installed under this Section. Pad foundations shall be 3-1/2 inches high minimum, unless otherwise indicated on Drawings. Edges shall be chamfered one inch. Faces shall be free of voids and rubbed smooth with carborundum block after stripping of forms. Tops of pads shall be dead level. Provide short dowel rods into floor for lateral stability and anchorage.

B. Set equipment anchor bolts in galvanized sheet metal sleeves one inch larger than bolt diameter. Secure each sleeve to a template and secure template to forms.

C. Machinery bases, bed plates, sole plates, and vibration isolation units shall be carefully aligned, shimmed, and leveled, then grouted in place with Embeco Grout (Master Builders).

D. For each surface mounted panel, provide a concrete floor curb around conduits which rise from below to the panel. Curb height shall correspond to the finish wall base material, but be not less than 3 inches high. Depth shall suit requirements but be not less than 6 inches deep (wall to face) and provide at least 2 inches concrete cover over the conduits.

3.03 INSTALLATION

A. Special care shall be taken during load balance to assure that reverse rotation of motors is not caused.

B. Materials installed under this Division of Work shall be supported from the building structure, independent of other pipe, duct, and equipment, except recessed "lay-in" fixtures not larger

than 2 feet by 4 feet size may be supported as stipulated in other Divisions and Sections of Division 26.

C. Conductors and cables shall be installed in conduit and other specified raceways which have been properly supported and anchored, unless otherwise specified.

D. The Contractor shall install major and secondary control equipment and erect on approved type brackets or floor supports, located as directed, and make electric connections to major and secondary control equipment and motor or apparatus, complete, and assume full responsibility for the connections.

E. Install taps and connections in properly selected outlet boxes and junction boxes. Install pull boxes only as required. Enclosures for wiring connections of motor controllers or switches shall not be used as junction boxes for cable tapping or splicing, except where the enclosures are designed to provide space which is suitable, adequate, and approved for the purpose.

F. Cover and protect equipment, materials, enclosures, boxes, and raceways, before and after installation, to prevent injury and to prevent entrance of grit, dirt, and foreign matter.

G. Phase, neutral, and ground conductors of a given circuit must be in the same raceway. Circuiting shall be as specified and denoted on the Drawings, with loads balanced as closely as possible across all phase legs.

H. Make final electrical connections of equipment to rough-ins and the electrical system.

I. Equip outlets with fittings and outlet boxes adapted to that particular outlet.

J. Exposed outlets shall be equipped with heavy cast type boxes, such as "FS" and "FSA" type conduits. Exposed raceways in finished spaces shall be wiremold type finished to match adjacent surfaces in which case outlet boxes shall be compatible with the raceway system.

K. The ends of raceway systems and conduits shall be carefully and securely capped during construction.

3.04 ACCESS DOORS

A. Locate panels accurately in coordination with the General Construction requirements and as directed by the Architect. Panels are to be provided in unaccessible ceilings and walls where necessary to provide access to equipment and wiring as required.

3.05 DISCONNECTS

A. Provide properly sized disconnects for apparatus and equipment whenever disconnecting means is not furnished by others. Each device, apparatus, or equipment must have local disconnecting means within actual sight of the motor or apparatus, and within 49 feet of the same.

3.06 TESTING

A. Voltage and System Testing, Checking, and Reports
   1. The Contractor shall:
      a. Test and record voltages and ground loop impedance at various outlets. One for each panelboard affected during project.
      b. Test and determine that new system is free of short circuits and other faults.
      c. Verify that motor overload devices are properly sized.
      d. Record nameplate data for motors, together with final voltage, running current, size of run protection fuses, and thermal overloads.
      e. Test insulation integrity of existing main service cables, existing main branch panel feeder cables, switchgear, for 208 volt services with 500 volt megger between phases and between each phase and ground with test maintained until readings are steady. Minimum acceptable reading is 30 megohms.

2. Contractor shall conduct such other tests and adjustments of equipment as required by Architect/Engineer or necessary to verify performance requirements. Submit data taken during such tests to Architect/Engineer. Contractor shall pay professional engineering fees involved in required testing of equipment.
3. Electrical Contractor shall provide necessary electrical personnel and testing instruments as required to assist Architect/Engineer in testing of installation.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Floor marking tape.

F. Warning signs and labels.

G. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

B. Section 26 05 19 - CONDUCTORS: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

C. 26 0533.13 - Conduit.

D. 26 0533.16 - Boxes.

E. 26 2726 - Wiring Devices.

F. 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2021.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Switchboards:

1) Identify power source and circuit number. Include location of power source when not within sight of equipment.
2) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Panelboards:
1) Identify power source and circuit number. Include location of power source when not within sight of equipment.
2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Enclosed switches:
1) Identify power source and circuit number. Include location when not within sight of equipment.
2) Identify load(s) served.

2. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
3. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
4. Use field-painted floor markings or floor marking tape to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
a. Minimum Size: 3.5 by 5 inches.
b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
c. Service Equipment: Include the following information in accordance with NFPA 70.
1) Nominal system voltage.
2) Available fault current.
3) Date label applied.
6. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
a. Within boxes when more than one circuit is present.

C. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits 1-1/2" (41mm) trade size and larger at maximum intervals of 20 feet.

D. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
   2. Use voltage markers or color coded boxes to identify systems other than normal power system.
      a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 and 09 91 13 per the same color code used for raceways.
         1) Fire Alarm System: Red.
      b. For exposed boxes in public areas, do not color code exterior.
   3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
      a. For exposed boxes in public areas, use only identification labels.
   4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

E. Identification for Devices:
   1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
   2. Use identification label to identify fire alarm system devices.
      a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
   3. Use identification label on exterior of wallplate to identify serving branch circuit for all receptacles.
      a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.02 MANUFACTURERS

A. Brady Corporation.

B. Seton Identification Products.

C. HellermannTyton.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 IDENTIFICATION

A. Identification of Electrical Conduits and Raceways
   1. Electrical conduit which is accessible for maintenance operations (except conduits in finished spaces) shall be identified with approved stencils or semi-rigid plastic identification pipe markers, electrical markers, or approved equal.
   2. For stencils use black enamel (except white on black, red, blue or dark backgrounds). Where lines are painted, apply stenciling after the finish coat dried. Characters shall be one inch high and when dry shall be coated with clear lacquer or approved equivalent.
   3. Electrical markers to be used on diameters 3/4 inch through 5 inches.
   4. Electrical markers to be used on diameters 6 inches or larger (with wire bindings and seals).
   5. Markers (or stencils) shall be located adjacent to each junction box, pull box, controller, panelboard, relay, and the like.
   6. At Contractor's option, covers only of junction boxes shall be labeled or stenciled (in lieu of conduit) with approved permanent labels denoting voltage and circuit designation inside box (for single-phase legs, label voltage to ground; for two or more phase legs, label the phase-to-phase voltage; and combinations shall be suitably labeled).

B. Equipment Identification
   1. Provide nameplates on equipment such as panelboards, distribution panels, motor starters, safety switches, control devices, and the like.
   2. Lettering shall include name of equipment, the specific unit number, and reference to on/off or other instructions that are applicable.
   3. Power panelboards, distribution panels, and motor control centers shall have a nameplate for each section of same and for each device contained therein, i.e., "Panel A," "Sump Pump," as is applicable.
   4. Nameplates shall be laminated phenolic with a white surface and black core. Use 1/16 inch thick material for plates up to 2 inches by 4 inches. For larger sizes use 1/8 inch thick material. Lettering of names should correspond to nomenclature specified for apparatus, corresponding with the Drawings, details, schedules, charts, wiring diagrams, and operating instructions as approved by the Architect/Engineer.
   5. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4 inch minimum height letters which occupy 4 to the inch in width. Increase letter size to 3/4 inch on largest plates.
   6. In addition, feeder circuits which serve devices (panelboards, appliances) that are located remote from (more than 3 feet from) their main circuit protective device shall have approved identification installed where and as directed which indicates the origin of the power supply, feeder size, and location of main protective device, i.e., "Feeder No. 3; 4-500 MCM, 1-2 AWG Ground, 4" C.; Main Switchboard Circuit 13"; as is applicable.
   7. Appliances, motors, heaters, and the like which are served by a separately mounted disconnect switch, motor starter, or combination type motor starter shall be labeled accordingly for easy identification, i.e.:
      a. Combination Starter: "HVAC-4" - "Supply Air Fan Motor"
      b. Motor at HVAC Unit: "HVAC-4" - "Supply Air Fan Motor"
      c. Disconnect Switch: "HVAC-3" - "Primary Air Heater"
      d. Heater at HV Unit: "HVAC-3" - "Primary Air Heater"
   8. Nameplates to be .020 inch to .064 inch thick aluminum, not less than 3/4 inches by 2-1/2 inches or 1 inch by 3 inches, except 1-1/2 inches by 4 inches or 3 inches by 6 inches for large items. Plates shall have a colored enamel background, with etched or engraved natural aluminum lettering not less than 3/16 inch high, except 1/4 inch high for 1 inch by 3 inches and 1-1/2 inches by 4 inch plates and 1/2 inch high for 1-3/4 inches by 6 inches and larger plates (unless specifically described elsewhere in this Specification).
   9. Background color shall be black,or as otherwise required. Plate shall have pressure sensitive permanent adhesive factory backing, as approved.
   10. Note: Use 3/4 inch by 2-1/4 inch size for single gang face plates, 1-1/4 inches by 4 inches for two gang plates attached with black, round head, self threading screws, made of 1/16 inch minimum thick, laminated phenol resin sheet, with white background and black ink or lacquer filled lettering.
   11. Attached directly to the apparatus in a manner approved by the Architect/Engineer.

C. Outlet Box Covers (or finishing plates)
   1. Indicate circuit numbers in box on back (box) side of cover (plate) using heavy line laundry marker pen.

D. Indexing
   1. Index each distribution center circuit and each panel circuit, clearly, neatly, and completely, including "Spares." Index shall be typewritten upon heavy card stock paper not subject to fading or mildew and shall be covered with a clear plastic window, and held securely in a suitable frame. Type date (month and year) and panel designation on each index.

2. Each index shall be sequenced in accord with actual panel circuiting, i.e.:
    a. Left side - top to bottom - 1, 3, 5, 7
    b. Right side - top to bottom - 2, 4, 6, 8
    c. All circuits shall be visible without removing panel index.
3. Standard index cards printed 1, 2, 3, are not acceptable.
4. Use actual Owner provided room numbers for circuit labeling in lieu of construction room numbers. Indexes provided with the Drawings are not suitable to use as panelboard indexes.

E. Other Items
1. Provide identification as required in other subsections of these Specifications and as denoted on the Drawings.

2.04 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
2. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
    a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
    a. Equipment Designation: 1/2 inch.
5. Color:
    a. Normal Power System: White text on black background.
    b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Designation indicated and device zone or address.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Red text on white background.

H. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

I. Locations:
   1. Each electrical distribution and control equipment enclosure.
   2. Communication cabinets.

J. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

2.05 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: Cloth type wire markers.

H. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

I. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.06 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

D. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 05 55
CONNECTORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

B. Refer to Section 01 2300 for Alternates that may affect the Work of this Section.

1.02 SUMMARY

A. Provide required materials for a complete system.

B. Upon request, points of junction, splices, taps, connections, pull boxes, and outlets shall be opened for inspection by Architect/Engineer or other approved authority.

PART 2 PRODUCTS

2.01 MATERIALS

A. Connectors shall be similar and equal to those manufactured by O.Z. Electrical Manufacturing Company, Burndy Engineering Company, Thomas & Betts Company.

B. Splices, taps, and other connections involving conductors not larger than No. 8 AWG max. shall be made with insulated connectors like 3M Co. "Scotchloks," Ideal Co. "Wing-Nut," or T & B Co. "Piggy" connectors. Connectors shall be wrapped with 8.5 mil heavy duty, premium grade all-weather vinyl electrical insulating tape.

C. Splices, taps, and other connections involving conductors larger than No. 8 AWG shall be made using approved compression type connectors, insulated with at least four 1/2 lap layers of 8.5 mil heavy duty, premium grade all-weather vinyl electrical insulating tape and covered overall with at least two 1/2 lap wraps of friction tape.

D. Connections or joints in wet or damp areas shall be waterproofed in an approved manner.

E. Connections of aluminum conductors are not acceptable.

F. Connectors shall be sized to carry 100 percent of the current capacity of the conductors connected. Conductors shall not be trimmed to fit a connection, the connection device shall be changed to accommodate the conductor.

G. Compression lugs shall be by T&B, O.Z. Electrical Manufacturing, or Burndy Engineering Company.

PART 3 EXECUTION

3.01 INSTALLATION

A. Splices and taps shall be made using approved mechanical connectors of the type best suited.

B. Under no circumstances will a soldered splice, tap, or connection be acceptable.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

B. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33.16 - BOXES.

B. Section 26 0526 - Grounding and Bonding

C. Section 26 05 83 - EQUIPMENT WIRING: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

D. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements for additional provisions

B. Furnish two of each style, size, and finish wall plate.

C. Provide two protective rings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper

B. Arrow Hart

C. Pass & Seymour

D. Hubbell

E. Leviton

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed in outdoor,wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles serving electric drinking fountains.

2.03 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Finishes: Match existing; Light Almond, stainless steel plates.

2.04 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.
   1. Listed and Labelled as Tamper-Resistant type
   2. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   3. NEMA configurations specified are according to NEMA WD 6.

B. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
      b. Listed and labelled as tamper-resistant type.
   2. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

D. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.
   1. Device Body: Ivory plastic.
   2. Configuration: NEMA WD 6, type as specified and indicated.
   3. Prewired pigtail connectors that accommodate Fed Spec receptacles are approved. Must be crimped and welded terminal application connector.

E. Convenience Receptacles: Type 5 - 20 equal to Hubbell 5362, Cooper BR20, or Pass & Seymour CR20W.
   1. Prewired pigtail receptacles: Type 5 - 20 equal to Pass & Seymour PT5362, Hubbell SNAP5362, or Cooper ArrowLink.

F. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.05 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Cover Plates: Smooth stainless steel.

C. Weatherproof covers to be metal hinged covers that allows cord to be plugged in with cover closed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Connect wiring device grounding terminal to outlet box with bonding jumper.

Q. Install standard plates on switch, receptacle, and blank outlets in finished areas.

R. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

S. Install protective rings on active flush cover service fittings.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 37 to obtain mounting heights specified.

B. Mounting heights refer to bottom of box.

C. Install convenience receptacle 16 inches above finished floor, UNO.

D. Install convenience receptacle 4 inches above backsplash of counter, UNO.

3.05 FIELD QUALITY CONTROL

A. See Section 01 43 00 - Quality Assurance, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Verify that each receptacle device is energized.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonfusible switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - HANGERS AND SUPPORTS.

B. Section 26 05 26 - Grounding and Bonding

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA (INST) - NECA Standard of Installation; National Electrical Contractors Association; 1993.

C. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).

D. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

E. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Submittal Procedures

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Square D

B. Siemens.

C. Cutler Hammer

D. **ABB**

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle lockable in OFF position.

B. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

A. See Section 01 43 00 - Quality Assurance, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

END OF SECTION

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FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

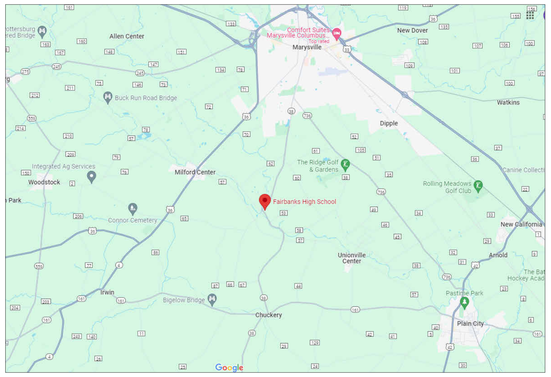
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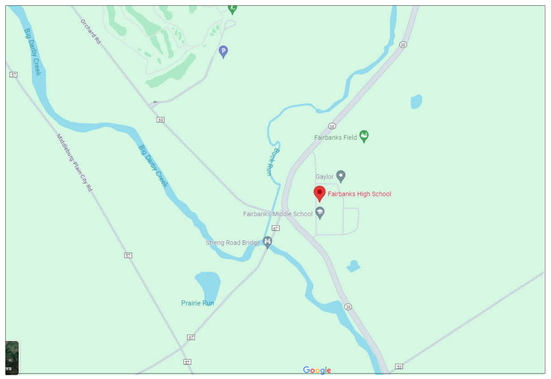
CONSTRUCTION DOCUMENTS **09/30/2026**

SHEET INDEX

SHEET NUMBER	SHEET NAME	09/30/2026 - CONSTRUCTION DOCUMENTS
G0.1	COVER SHEET	•
G1.0	CODE PLAN	•
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AD5.1	ROOF DEMOLITION PLAN	•
A5.1	ROOF PLAN	•
P1.1	GENERAL NOTES, ABBREVIATIONS, LEGENDS AND SHEET INDEX	•
PD1.1	PLUMBING OVERALL DEMOLITION PLAN	•
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M1.1	GENERAL NOTES, ABBREVIATIONS, LEGENDS AND SHEET INDEX	•
MD1.1	MECHANICAL DEMOLITION PLAN - UNIT A	•
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M3.1	MECHANICAL PIPING PLAN - UNIT D	•
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M6.1	TEMPERATURE CONTROL PLAN - UNIT A	•
M6.2	TEMPERATURE CONTROL PLAN - UNIT D	•
E1.1	GENERAL NOTES, ABBREVIATIONS, LEGENDS AND SHEET INDEX	•
ED1.1	ELECTRICAL ROOF DEMOLITION PLAN - OVERALL	•
E2.1	ELECTRICAL ROOF PLAN - OVERALL	•

1





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SMBH STRUCTURAL ENGINEERING

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TREASURER.....AARON JOHNSON

Ohio Facilities Construction Commission

SCHOOL BUILDING IMPROVEMENTS IN THE

FAIRBANKS LOCAL SCHOOLS

ARE FUNDED THROUGH A PARTNERSHIP WITH THE

OHIO FACILITIES CONSTRUCTION COMMISSION ELPP PROGRAM

MIKE DEWINE, GOVERNOR
CHERYL LYMAN, EXECUTIVE DIRECTOR

PROJECT GOVERNED BY 2024 OSDM

ARCHITECTS
MECHANICAL, ELECTRICAL & PLUMBING ENGINEERS
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STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MINSTER, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
GMDesignGroup.com

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11158 OH-38, MILFORD CENTER, OHIO 45045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	MLE	JTM

SHEET TITLE:
COVER SHEET

SHEET NUMBER:
G0.1

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CODE INFORMATION

APPLICABLE CODE: 2024 OHIO EXISTING BUILDING CODE
ALTERATION OF EXISTING BUILDING TO COMPLY WITH THE PRESCRIPTIVE COMPLIANCE METHOD PER OEBC 301.3

BUILDING DESCRIPTION: EXISTING MIDDLE SCHOOL / HIGH SCHOOL

SCOPE OF WORK: MECHANICAL HVAC REPLACEMENT

STUDENT / STAFF DESIGN (ACTUAL OCCUPANTS)
- STUDENTS: NO CHANGE
- STAFF: NO CHANGE
- TOTAL: NO CHANGE

NUMBER OF EXITS
- REQUIRED: 4
- ACTUAL: 10

DESIGN UNIFORM LOAD: SEE STRUCTURAL SHEETS

NOTE:
NO CHANGE TO EXISTING BUILDING AREA OR OCCUPANCY

BUILDING AREA 1

OCCUPANCY / USE GROUP: E (NO CHANGE)
OBC 303.1.3: GYMNASIUMS TO BE CLASSIFIED AS GROUP E.

CONSTRUCTION TYPE: TYPE II-B (NO CHANGE)

ALLOWABLE AREA (TABLE 506.2): 14,500 SF

BUILDING FRONTAGE AREA INCREASE (TABLE 506.3): NOT CALCULATED

TOTAL ALLOWABLE AREA: 14,500 SF

ACTUAL BUILDING AREA: 100,383 SF (NO CHANGE)

BUILDING AREA SCHEDULE - OFCC

AREA NUMBER	LEVEL	AREA	NOTES
AREA 1	FIRST FLOOR	100,383 SF	NO CHANGE FROM EXISTING
Grand total		100,383 SF	

PLUMBING FIXTURE COUNTS

	EXISTING	PROPOSED
WATER CLOSETS - MALE:	9	9
URINALS - MALE:	16	14
WATER CLOSETS - FEMALE:	14	16
LAVATORIES - MALE:	15	15
LAVATORIES - FEMALE:	13	13
DRINKING FOUNTAINS:	6	6
1 SERVICE SINKS:	3	3
UNISEX RESTROOMS (WC & LAV):	12	15

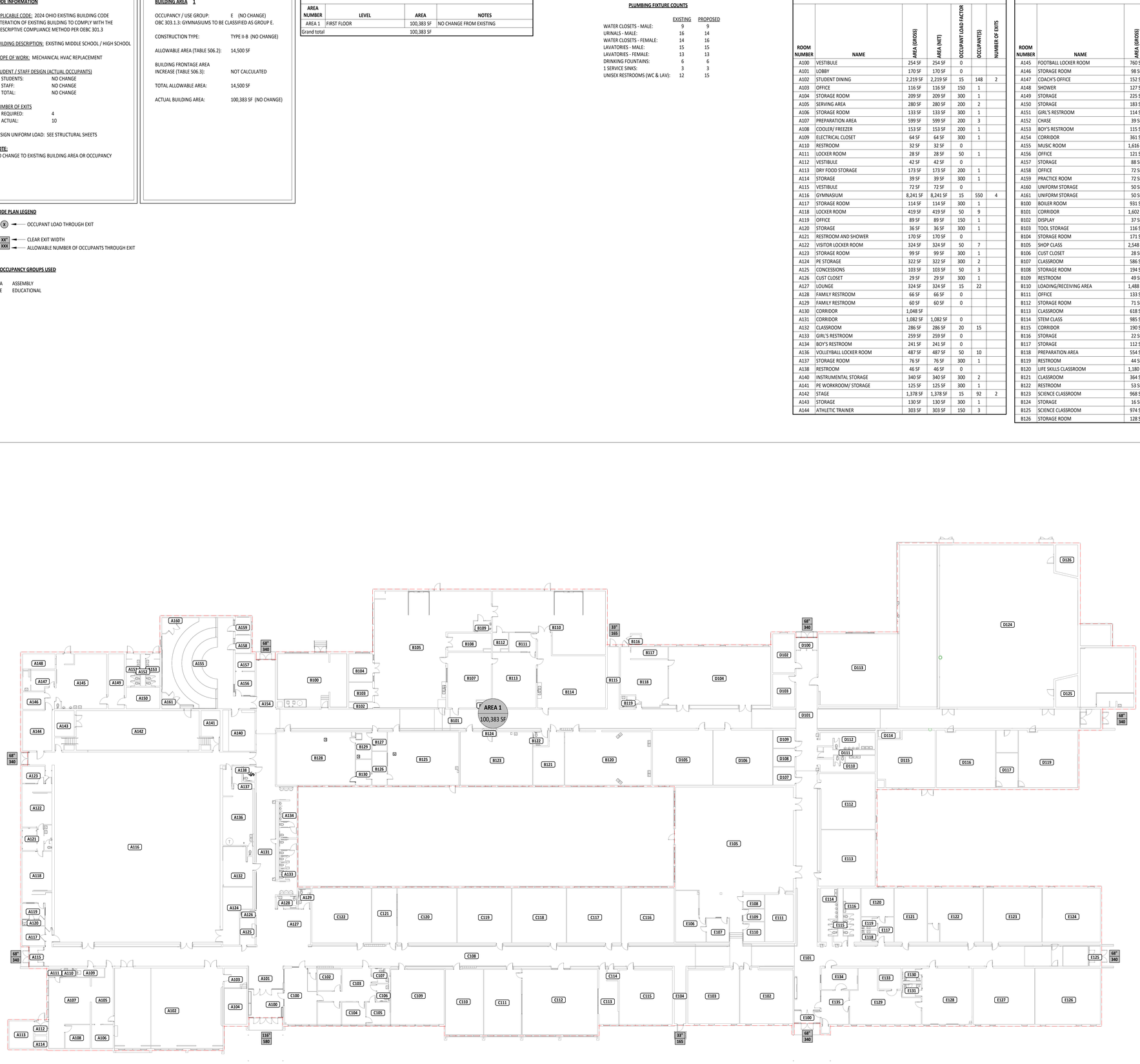
CODE PLAN LEGEND

(X) — OCCUPANT LOAD THROUGH EXIT

XX" / XXX — CLEAR EXIT WIDTH / ALLOWABLE NUMBER OF OCCUPANTS THROUGH EXIT

OCCUPANCY GROUPS USED

A ASSEMBLY
E EDUCATIONAL



1 G1.0 **FIRST FLOOR CODE PLAN**
1" = 20'-0"

N

OCCUPANCY TABULATION PER 2024 OBC TABLE 1004.1.2 - L1

ROOM NUMBER	NAME	AREA (GROSS)	AREA (NET)	OCCUPANT LOAD FACTOR	OCCUPANT(S)	NUMBER OF EXITS
A100	VESTIBULE	254 SF	254 SF	0		
A101	LOBBY	170 SF	170 SF	0		
A102	STUDENT DINING	2,219 SF	2,219 SF	15	148	2
A103	OFFICE	116 SF	116 SF	150	1	
A104	STORAGE ROOM	209 SF	209 SF	300	1	
A105	SERVING AREA	280 SF	280 SF	200	2	
A106	STORAGE ROOM	133 SF	133 SF	300	1	
A107	PREPARATION AREA	599 SF	599 SF	200	3	
A108	COOLER/ FREEZER	153 SF	153 SF	200	1	
A109	ELECTRICAL CLOSET	64 SF	64 SF	300	1	
A110	RESTROOM	32 SF	32 SF	0		
A111	LOCKER ROOM	28 SF	28 SF	50	1	
A112	VESTIBULE	42 SF	42 SF	0		
A113	DRY FOOD STORAGE	173 SF	173 SF	200	1	
A114	STORAGE	39 SF	39 SF	300	1	
A115	VESTIBULE	72 SF	72 SF	0		
A116	GYMNASIUM	8,241 SF	8,241 SF	15	550	4
A117	STORAGE ROOM	114 SF	114 SF	300	1	
A118	LOCKER ROOM	419 SF	419 SF	50	9	
A119	OFFICE	89 SF	89 SF	150	1	
A120	STORAGE	36 SF	36 SF	300	1	
A121	RESTROOM AND SHOWER	170 SF	170 SF	0		
A122	VISITOR LOCKER ROOM	324 SF	324 SF	50	7	
A123	STORAGE ROOM	99 SF	99 SF	300	1	
A124	PE STORAGE	322 SF	322 SF	300	2	
A125	CONCESSIONS	103 SF	103 SF	50	3	
A126	CUST CLOSET	29 SF	29 SF	300	1	
A127	LOUNGE	324 SF	324 SF	15	22	
A128	FAMILY RESTROOM	66 SF	66 SF	0		
A129	FAMILY RESTROOM	60 SF	60 SF	0		
A130	CORRIDOR	1,048 SF				
A131	CORRIDOR	1,082 SF	1,082 SF	0		
A132	CLASSROOM	286 SF	286 SF	20	15	
A133	GIRL'S RESTROOM	259 SF	259 SF	0		
A134	BOY'S RESTROOM	241 SF	241 SF	0		
A136	VOLLEYBALL LOCKER ROOM	487 SF	487 SF	50	10	
A137	STORAGE ROOM	76 SF	76 SF	300	1	
A138	RESTROOM	46 SF	46 SF	0		
A140	INSTRUMENTAL STORAGE	340 SF	340 SF	300	2	
A141	PE WORKROOM/ STORAGE	125 SF	125 SF	300	1	
A142	STAGE	1,378 SF	1,378 SF	15	92	2
A143	STORAGE	130 SF	130 SF	300	1	
A144	athletic trainer	303 SF	303 SF	150	3	

OCCUPANCY TABULATION PER 2024 OBC TABLE 1004.1.2 - L1

ROOM NUMBER	NAME	AREA (GROSS)	AREA (NET)	OCCUPANT LOAD FACTOR	OCCUPANT(S)	NUMBER OF EXITS
A145	FOOTBALL LOCKER ROOM	760 SF	760 SF	50	16	
A146	STORAGE ROOM	98 SF	98 SF	300	1	
A147	COACH'S OFFICE	152 SF	152 SF	150	2	
A148	SHOWER	127 SF	127 SF	0		
A149	STORAGE	225 SF	225 SF	300	1	
A150	STORAGE	183 SF	183 SF	300	1	
A151	GIRL'S RESTROOM	114 SF	114 SF	0		
A152	CHASE	39 SF	39 SF	0		
A153	BOY'S RESTROOM	115 SF	115 SF	0		
A154	CORRIDOR	361 SF	361 SF	0		
A155	MUSIC ROOM	1,616 SF	1,616 SF	50	33	
A156	OFFICE	121 SF	121 SF	150	1	
A157	STORAGE	88 SF	88 SF	300	1	
A158	OFFICE	72 SF	72 SF	300	1	
A159	PRACTICE ROOM	72 SF	72 SF	300	1	
A160	UNIFORM STORAGE	50 SF	50 SF	300	1	
A161	UNIFORM STORAGE	50 SF	50 SF	300	1	
B100	BOILER ROOM	931 SF	931 SF	300	4	
B101	CORRIDOR	1,602 SF	1,602 SF	0		
B102	DISPLAY	37 SF	37 SF	0		
B103	TOOL STORAGE	116 SF	116 SF	300	1	
B104	STORAGE ROOM	171 SF	171 SF	300	1	
B105	SHOP CLASS	2,548 SF	2,548 SF	50	51	2
B106	CUST CLOSET	28 SF	28 SF	300	1	
B107	CLASSROOM	586 SF	586 SF	20	30	
B108	STORAGE ROOM	194 SF	194 SF	300	1	
B109	RESTROOM	49 SF	49 SF	0		
B110	LOADING/RECEIVING AREA	1,488 SF	1,488 SF	300	5	
B111	OFFICE	133 SF	133 SF	150	1	
B112	STORAGE ROOM	71 SF	71 SF	300	1	
B113	CLASSROOM	618 SF	618 SF	20	31	
B114	STEM CLASS	985 SF	985 SF	50	20	
B115	CORRIDOR	190 SF	190 SF	0		
B116	STORAGE	22 SF	22 SF	300	1	
B117	STORAGE	112 SF	112 SF	300	1	
B118	PREPARATION AREA	554 SF	554 SF	200	3	
B119	RESTROOM	44 SF	44 SF	0		
B120	LIFE SKILLS CLASSROOM	1,180 SF	1,180 SF	50	24	
B121	CLASSROOM	364 SF	364 SF	20	19	
B122	RESTROOM	53 SF	53 SF	0		
B123	SCIENCE CLASSROOM	968 SF	968 SF	20	49	
B124	STORAGE	16 SF	16 SF	300	1	
B125	SCIENCE CLASSROOM	974 SF	974 SF	20	49	
B126	STORAGE ROOM	128 SF	128 SF	300	1	

OCCUPANCY TABULATION PER 2024 OBC TABLE 1004.1.2 - L1

ROOM NUMBER	NAME	AREA (GROSS)	AREA (NET)	OCCUPANT LOAD FACTOR	OCCUPANT(S)	NUMBER OF EXITS
B127	STORAGE	73 SF	73 SF	300	1	
B128	SCIENCE CLASSROOM	1,067 SF	1,067 SF	50	22	
B129	STORAGE	109 SF	109 SF	300	1	
B130	STORAGE ROOM	104 SF	104 SF	300	1	
C100	RECEPTION/ SECRETARIAL AREA	450 SF	450 SF	150	3	
C101	OFFICE	133 SF				
C102	OFFICE	128 SF	128 SF	150	1	
C103	TEACHER PREP	333 SF	333 SF	150	3	
C104	OFFICE	133 SF	133 SF	150	1	
C105	TEACHER CONFERENCE	133 SF	133 SF	150	1	
C106	RESTROOM	53 SF	53 SF	0		
C107	RESTROOM	54 SF	54 SF	0		
C108	CORRIDOR	1,929 SF	1,929 SF	0		
C109	HIGH SCHOOL CLASSROOM	749 SF	749 SF	20	38	
C110	HIGH SCHOOL CLASSROOM	632 SF	632 SF	20	32	
C111	HIGH SCHOOL CLASSROOM	625 SF	625 SF	20	32	
C112	ART CLASSROOM	1,259 SF	1,259 SF	50	26	
C113	KILN/ CERAMIC STORAGE	241 SF	241 SF	300	1	
C114	STORAGE	28 SF	28 SF	300	1	
C115	HIGH SCHOOL CLASSROOM	740 SF	740 SF	20	37	
C116	HIGH SCHOOL CLASSROOM	738 SF	738 SF	20	37	
C117	HIGH SCHOOL CLASSROOM	758 SF	758 SF	20	38	
C118	HIGH SCHOOL CLASSROOM	758 SF	758 SF	20	38	
C119	HIGH SCHOOL CLASSROOM	758 SF	758 SF	20	38	
C120	HIGH SCHOOL CLASSROOM	831 SF	831 SF	20	42	
C121	SMALL GROUP ROOM	348 SF	348 SF	20	18	
C122	HIGH SCHOOL CLASSROOM	833 SF	833 SF	20	42	
C123	STORAGE	10 SF				
D100	VESTIBULE	69 SF	69 SF	0		
D101	CORRIDOR	3,003 SF	3,003 SF	0		
D102	RECEPTION/ SECRETARIAL AREA	220 SF	220 SF	150	2	
D103	PRINCIPAL'S OFFICE	186 SF	186 SF	150	2	
D104	STUDENT DINING	1,527 SF	1,527 SF	15	102	2
D105	MIDDLE SCHOOL CLASSROOM	846 SF	846 SF	20	43	
D106	MIDDLE SCHOOL CLASSROOM	835 SF	835 SF	20	42	
D107	OFFICE	99 SF	99 SF	150	1	
D108	OFFICE	98 SF	98 SF	150	1	
D109	OFFICE	98 SF	98 SF	150	1	
D110	GIRL'S RESTROOM	223 SF	223 SF	0		
D111	CHASE	79 SF	79 SF	0		
D112	BOY'S RESTROOM	223 SF	223 SF	0		
D113	MIDDLE SCHOOL LAB CLASSROOM	1,432 SF	1,432 SF	50	29	0
D114	VESTIBULE	49 SF	49 SF	0		
D115	MAINTENANCE	774 SF	774 SF	300	3	
D116	MIDDLE SCHOOL CLASSROOM	864 SF	864 SF	20	44	
D117	OFFICE/ WORKROOM	195 SF	195 SF	150	2	
D118	OFFICE	124 SF	124 SF	150	1	
D119	MIDDLE SCHOOL CLASSROOM	864 SF	864 SF	20	44	
D120	VESTIBULE	99 SF	99 SF	0		
D121	LIFE SKILLS LAB	672 SF	672 SF	50	14	
D122	LIFE SKILLS LAB	129 SF	129 SF	50	3	
D123	GARAGE	159 SF	159 SF	300	1	
D124	GYMNASIUM	5,355 SF	5,355 SF	15	358	4
D125	STORAGE ROOM	165 SF	165 SF	300	1	
D126	STORAGE ROOM	165 SF	165 SF	300	1	
D127	LOCKER ROOM	650 SF	650 SF	50	14	
D128	STORAGE	33 SF	33 SF	300	1	
D129	STORAGE	61 SF	61 SF	300	1	
D130	LOCKER ROOM	687 SF	687 SF	50	14	
D131	STORAGE	61 SF	61 SF	300	1	
E100	VESTIBULE	85 SF	85 SF	0		
E101	CORRIDOR	3,468 SF	3,468 SF	0		
E102	CLASSROOM	735 SF	735 SF	20	37	
E103	CLASSROOM	712 SF	712 SF	20	36	
E104	CORRIDOR	171 SF	171 SF	0		
E105	MEDIA CENTER	3,534 SF	3,534 SF	50	71	2
E106	TECHNOLOGY OFFICE	348 SF	348 SF	150	3	
E107	OFFICE	138 SF	138 SF	150	1	
E108	OFFICE	75 SF	75 SF	150	1	
E109	STORAGE ROOM	66 SF	66 SF	300	1	
E110	OFFICE	108 SF	108 SF	150	1	
E111	SMALL GROUP ROOM	343 SF	343 SF	20	18	
E112	MIDDLE SCHOOL CLASSROOM	773 SF	773 SF	20	39	
E113	MIDDLE SCHOOL CLASSROOM	781 SF	781 SF	20	40	
E114	BOY'S RESTROOM	223 SF	223 SF	0		
E115	CHASE	88 SF	88 SF	0		
E116	GIRL'S RESTROOM	224 SF	224 SF	0		
E117	VESTIBULE	102 SF	102 SF	0		
E118	RESTROOM	49 SF	49 SF	0		
E119	RESTROOM	49 SF	49 SF	0		
E120	WELLNESS ROOM	236 SF	236 SF	20	12	
E121	MIDDLE SCHOOL CLASSROOM	453 SF	453 SF	20	23	
E122	MIDDLE SCHOOL CLASSROOM	706 SF	706 SF	20	36	
E123	MIDDLE SCHOOL CLASSROOM	804 SF	804 SF	20	41	
E124	MIDDLE SCHOOL CLASSROOM	804 SF	804 SF	20	41	
E125	VESTIBULE	57 SF	57 SF	0		
E126	MIDDLE SCHOOL CLASSROOM	940 SF	940 SF	20	47	
E127	MIDDLE SCHOOL CLASSROOM	879 SF	879 SF	20	44	
E128	TEACHERS LOUNGE	719 SF	719 SF	150	5	
E129	TEACHER WORKROOM	691 SF	691 SF	150	5	
E130	RESTROOM	61 SF	61 SF	0		
E131	RESTROOM	61 SF	61 SF	0		
E133	VAULT	122 SF	122 SF	150	1	
E134	MS PRINCIPAL	200 SF	200 SF	150	2	
E135	MS RECEPTION	239 SF	239 SF	150	2	

STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

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RENOVATION FOR
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11158 OH-38, MILFORD CENTER, OHIO 43045

ISSUANCES/REVISIONS

1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	MLE	JTM

SHEET TITLE:
CODE PLAN

SHEET NUMBER:
G1.0

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- NOTE:

	ABBREVIATIONS USED ON THE CONTRACT DOCUMENTS, INCLUDE BUT ARE NOT LIMITED TO THOSE LISTED BELOW.

- CHARACTERS

# / NO	NUMBER
° / DEG	DEGREE
Ø / DIA	DIAMETER
□ / SQ.	SQUARE
'	FEET
"	INCH
∟	ANGLE
&	AND
@	AT
d	PENNY (NAILS)
=	EQUAL

- MEASUREMENTS

°C	CELCIUS
°F	FAHRENHEIT
AC	ACRES
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
CF	CUBIC FEET
CFM	CUBIC FEET PER MINUTE
CI	CUBIC INCH
CY	CUBIC YARD
Db	DECIBEL
IN	INCH
FT	FEET
HR	HOUR
GAL	GALLONS
GPF	GALLONS PER FLUSH
GPH	GALLONS PER HOUR
KG	KILOGRAM
KW	KILOWATT
KWH	KILOWATT PER HOUR
LB	POUND
LF	LINEAR FOOT
M	METER
MIN	MINUTE
MM	MILLIMETER
PLF	POUNDS PER LINEAR FOOT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
SI	SQUARE INCH
SY	SQUARE YARD

A

AB	ANCHOR BOLT
AC	AIR CONDITIONING
ACC	ACCESSIBLE
ACOUS	ACOUSTICAL
ACT	ACOUSTICAL CEILING TILE
AD	AREA DRAIN
ADD	ADDITIONAL
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AFP	ACCORDION FOLDING PARTITION
AGGR	AGGREGATE
ALT	ALTERNATE
ALUM	ALUMINUM
ANCH	ANCHOR
ANOD	ANODIZED
AP	ACCESS PANEL
APPD	APPROVED
APPROX	APPROXIMATE
AR	ACID RESISTANT
ARCH	ARCHITECTURAL
ASPH	ASPHALT
AUTO	AUTOMATIC
AV	AUDIO-VISUAL
AWT	ACOUSTICAL WALL TREATMENT

B

BEJ	BRICK EXPANSION JOINT
BD	BOARD
BIT	BITUMINOUS
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BEAM / BENCHMARK
B/O	BOTTOM OF
BOT	BOTTOM
BRG	BEARING
BS	BOILER STACK
BSMT	BASEMENT
BT	BOLT
BUR	BUILT-UP ROOF
BYND	BEYOND

C

C	CLOSURE
CAB	CABINET
CAT	CATEGORY
CB	CATCH BASIN
CBD	CHALKBOARD
CBU	CEMENTITOUS BACKER UNIT
CEM	CEMENT
CER	CERAMIC
CG	CORNER GUARD
CH	CABINET HEATER / CEILING HEIGHT
CHNL	CHANNEL
CI	CAST IRON
CIP	CAST IN PLACE
CJ	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMP	CORRUGATED METAL PIPE
CMT	CERAMIC MOSAIC TILE
CMU	CONCRETE MASONRY UNIT
CNTR	COUNTER
CO	CLEANOUT
COL	COLUMN
COMP	COMPACT
COMPR	COMPRESSIBLE
CONC	CONCRETE
COND	CONDITION
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINOUS / CONTINUE
CONTR	CONTRACTOR
COORD	COORDINATE
CORR	CORRUGATED / CORRIDOR
CPT	CARPET
CT	CERAMIC TILE
CTR	CENTER
CTSK	COUNTER SINK
CTYD	COURTYARD
CW	COLD WATER
CWF	CEMENTITOUS WOOD FIBER

D

D	DEPTH
DA	DISABLED
DBL	DOUBLE
DC	DISPLAY CASE
DEMO	DEMOLITION
DEPT	DEPARTMENT
DET	DETAIL
DF	DRINKING FOUNTAIN
DIM	DIMENSION
DISP	DISPENSER
DIV	DIVISION
DL	DEAD LOAD
DMPF	DAMPPROOFING
DMT	DEMOUNTABLE
DN	DOWN
DO	DOOR OPENING
DP	DIMENSION POINT
DPTN	DEMOUNTABLE PARTITION
DR	DOOR
DRN	DRAIN
DS	DOWNSPOUT
DW	DISHWASHER
DWC	DRINKING WATER COOLER
DWG	DRAWING
DWR	DRAWER

E

E	EAST
EA	EACH
EB	EXPANSION BOLT
EF	EACH FACE
EFS	DIRECT APPLIED EXTERIOR FINISH SYSTEM
EFIS	EXTERIOR INSULATION FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
ELEV	ELEVATOR
EMERG	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EP	ELCTRICAL PANELBOARD
EMPD	ETHYLENE PROPYLENE DIENE M-CLASS ROOFING
EPX	EPOXY
EQ	EQUAL
EQUIP	EQUIPMENT
ESCAL	ESCALATOR
EW	EACH WAY
EXH	EXHAUST
EX/EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERIOR
EXTN	EXTENSION

F

FA	FIRE ALARM
FB	FACE BRICK
FC	FACE
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FDV	FIRE DEPARTMENT VALVE
FE	FIRE EXTINGUISHER / FINISH END
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FF&E	FURNITURE, FINISHES & EQUIPMENT
FH	FLAT HEAD
FHC	FIRE HOSE CABINET
FIN	FINISH
FIXT	FIXTURE
FLR	FLOOR
FLASH	FLASHING
FLOUR	FLOURESCENT
FM	FILLED METAL
FND	FOUNDATION
F/O	FACE OF
FP	FIRE PROTECTION
FPG	FIREPROOFING
FR	FRAME
FRTW	FIRE RETARDANT TREATED WOOD
FSR	FLEXIBLE SHEET ROOFING
FSSK	FLOOR SERVICE SINK
FTG	FOOTING
FURN	FURNITURE
FURR	FURRING
FWC	FABRIC WALLCOVERING
FWP	FABRIC WALL PANEL
FVC	FIRE VALVE CABINET

G

G / GRD	GROUND
GA	GAUGE
GALV	GALVANIZED
GB	GRAB BAR
GC	GENERAL CONTRACTOR
GFCMU	GROUND-FACED CONCRETE MASONRY UNIT
GFRC	GLASS FIBER REINFORCED CONCRETE
GFRGU	GLASS FIBER REINFORCED GYPSUM UNIT
GL	GLASS
GR	GRADE
GWB	GYPSUM WALLBOARD

H

HB	HOSE BIBB
HC	HOLLOW CORE
HCP	HAN
HDW	HARDWARE
HDWD	HARDWOOD
HGT	HEIGHT
HM	HOLLOW METAL (STEEL FRAME)
HNDRL	HANDRAIL
HO	HOLD OPEN
HORIZ	HORIZONTAL
HRC	HOSE REEL CABINET
HS	HIGH STRENGTH
HVAC	HEATING, VENTILATING & AIR CONDITIONING
HW	HOT WATER
HWY	HIGHWAY
HYDR	HYDRAULIC

I

ID	INSIDE DIAMETER
ILO	IN LIEU OF
INCAND	INCANDESCENT
INCL	INCLUDE
INFO	INFORMATION
INSUL	INSULATION
INT	INTERIOR
INTERM	INTERMEDIATE
INV	INVERT
IRGWB	IMPACT RESISTANT GYPSUM WALLBOARD

J

JAN	JANITOR
JC	JANITORIAL CLOSET
JST	JOIST
JT	JOINT

K

K	KNURLED
KIT	KITCHEN
KPL	KICK PLATE
KO	KNOCKOUT

L

L	LENGTH
LAB	LABORATORY
LAM	LAMINATE
LAV	LAVATORY
LDG	LANDING
LKR	LOCKER
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LN	LINE
LPT	LOW POINT
LT	LIGHT
LVR	LOUVER
LW	LONG WAY

M

MACH	MACHINE
MAINT	MAINTENANCE
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MB	MARKER BOARD
MBL	MARBLE
MFD	MEDIUM DENSITY FIBERBOARD
MEP	MECHANICAL, ELECTRICAL & PLUMBING
MECH	MECHANICAL
MEMB	MEMBRANE
MEZZ	MEZZANINE
MFR	MANUFACTURER
MH	MOP HANDLE / MAN HOLE
MIN	MINIMUM / MINUTE
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MRGWB	MOISTURE-RESISTANT GYPSUM WALLBOARD
MRT	MORTAR
MTD	MOUNTED
MTG	MOUNTING
MTL	METAL
MULL	MULLION

N

N	NORTH
NA	NOT APPLICABLE
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE

O

OA	OUTSIDE AIR
OC	ON CENTER
OCEW	ON CENTER EACH WAY
OD	OUTSIDE DIAMETER
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
OFF	OFFICE
OH	OVERHEAD
OPH	OPPOSITE HAND
OPNG	OPENING
OPP	OPPOSITE
ORD	OVERFLOW ROOF DRAIN
OUTS	OUTSIDE
OVHD	OVERHEAD
OW	OPERABLE WALL

P

P	PAINT
PA	PUBLIC ADDRESS
PAV	PAVING
PARTN	PARTITION
PATD	PAPER TOWEL DISPENSER
PBD	PARTICLEBOARD
PC	PRECAST CONCRETE
PERF	PERFORATED
PERIM	PERIMETER
PERP	PERPENDICULAR
PLAM	PLASTIC LAMINATE
PLAS	PLASTER
PL	PROPERTY LINE / PLATE
PLBG	PLUMBING
PLYWD	PLYWOOD
PNL	PANEL
POL	POLISHED
PR	PAIR
PREFAB	PREFABRICATED
PROJ	PROJECT
PS	PROJECTION SCREEN
PSS	PENCIL SHARPENER SUPPORT
PT	PAINT
PTN	PARTITION
PTR	PAPER TOWEL RECEPTACLE
PV	PAVERS
PVC	POLYVINYL CHLORIDE PIPE
PVMT	PAVEMENT

Q

QT	QUARRY TILE
QTY	QUANTITY

R

R	RADIUS
RA	RETURN AIR
RB	RESILIENT BASE
RBR	RUBBER
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REC	RECESSED
RECOM	RECOMMENDED
RECPT	RECEPTACLE
REF	REFERENCE
REFL	REFLECT
REFR	REFRIGERATOR
REG	REGISTER
REINF	REINFORCE
REM	REMOVABLE
REQD	REQUIRED
RESIL	RESILIENT
REV	REVISION
RFG	ROOFING
RM	ROOM
RO	ROUGH OPENING
ROW	RIGHT OF WAY
RTD	RATED
RTG	RATING

S

S	SOUTH
SA	SUPPLY AIR
SAN	SANITARY
SC	SOLID CORE
SCWD	SOLID CORE WOOD DOOR
SCHED	SCHEDULE
SD	STORM DRAIN / SMOKE DETECTOR
SECT	SECTION
SEW	SEWER
SFCMU	SPLIT-FACED CONCRETE MASONRY UNIT
SGFT	STRUCTURAL GLAZED FACING TILE
SH	SHOWER
SHT	SHEET
SIM	SIMILAR
SLR	SEALER
SM	SHEET METAL
SND	SANITARY NAPKIN DISPENSER
SPECS	SPECIFICATIONS
SPKR	SPEAKER
SPH	SPRINKLER HEAD
SPR	SPRINKLER
SQ	SQUARE
SS	STAINLESS STEEL
SSE	STRUCTURAL SLAB ELEVATION
SSF	SOLID SURFACE
SSK	SERVICE SINK
ST	STORM / STREET
STA	STATION
STC	SOUND TRANSMISSION COEFFICIENT
STD	STANDARD
STE	SUITE
STL	STEEL
STLJST	STEEL JOIST
STN	STAIN
STOR	STORAGE
STRG	STRINGER
STRUCT	STRUCTURAL
SUBCAT	SUBCATEGORY
SUSP	SUSPENDED
SW	SHORT WAY / SIDEWALK
SYMM	SYMMETRICAL
SYNTH	SYNTHETIC
SYS	SYSTEM

T

T	TREAD / THERMOSTAT
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
TA	TOILET ACCESSORY
TB	TOWEL BAR
TEL	TELEPHONE
TEMP	TEMPERATURE
TER	TERRAZZO
THK	THICKNESS
THRES	THRESHOLD
THRU	THROUGH
TKBD	TACKBOARD
TMPD	TEMPERED
T/O	TOP OF
TPD	TOILET PAPER DISPENSER
TS	TRANSITION STRIP
TV	TELEVISION
TYP	TYPICAL
TWS	TACKABLE WALL SURFACE

U

UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UV	UNIT VENTILATOR
UR	URINAL

V

VAC	VENTILATION AND AIR CONDITIONING
VERT	VERTICAL
VEST	VESTIBULE
VIF	VERIFY IN FIELD
VIT	VITREOUS
VOL	VOLUME
VR	VAPOR RETARDER
VRB	VENTED RESILIENT BASE
VS	VENT STACK
VT	VINYL (ENHANCED / COMPOSITION) TILE
VWC	VINYL WALL COVERING

W

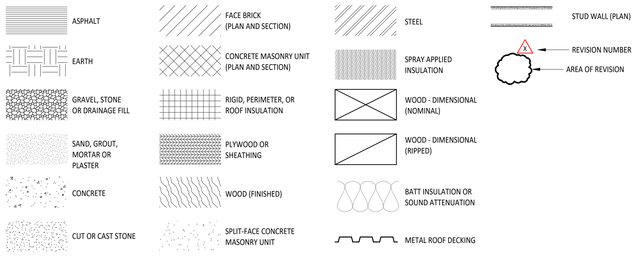
W	WEST / WIDTH
W/	WITH
W/O	WITHOUT
WA	WARDROBE ACCESSORIES
WB	WOOD BASE
WC	WATER CLOSET
WD	WOOD
WDW	WINDOW
WGT	WEIGHT
WH	WATER HEATER
WP	WATERPROOFING
WPM	WATERPROOF MEMBRANE
WR	WATER RESISTANT / REPELLANT
WS	WEATHERSTRIPPING
WSCT	WAINSCOT
WSSK	WALL SERVICE SINK
WT	WINDOW TREATMENT
WVR	WOOD VENEER
WW	WALL TO WALL
WWF	WELDED WIRE FABRIC

Y

YD	YARD / YARD DRAIN

ABBREVIATIONS

MATERIAL SYMBOLS USED ON THE CONTRACT DOCUMENTS, INCLUDE BUT ARE NOT LIMITED TO THOSE LISTED BELOW



DRAWING AND MATERIAL SYMBOLS LEGEND

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GENERAL NOTES

1

A REFERENCE GENERAL CONSTRUCTION NOTES AND SPECIFICATIONS FOR MORE INFORMATION AND BID ALTERNATES.

B REFERENCE SPECIFICATIONS AND DRAWINGS FOR SPECIAL REQUIREMENTS AND CONDITIONS.

C FINISH FIRST FLOOR ELEVATION INDICATED FOR THE NEW WORK IS 100'-0". REFERENCE SITE DRAWINGS FOR RELATIONSHIP TO U.S.G.S. DATUM. ELEVATIONS OF EXISTING ELEMENTS RELATIVE TO 100'-0" SHALL BE FIELD VERIFIED BY THE CONTRACTOR(S). CONTRACTOR(S) SHALL NOTIFY THE CONSTRUCTION MANAGER IMMEDIATELY OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.

D THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE WORK IS COMPLETE. CONTRACTOR(S) SHALL DETERMINE THE CONSTRUCTION PROCEDURES AND SEQUENCES AND ENSURE THE INTEGRITY OF THE WORK AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES SHORING, SHEATHING, TEMPORARY ENCLOSURES AND TEMPORARY POSITIVE WATER DRAINAGE FROM THE SITE AND ALL BUILDING ROOFS.

E CONTRACTOR(S) SHALL MAINTAIN ALL LEGAL EGRESS FROM THE WORK TO COMPLY WITH APPLICABLE BUILDING CODES, SAFETY REGULATIONS AND THE DISCRETION OF THE GOVERNING LOCAL BUILDING CODE AUTHORITIES FOR THE HEALTH, SAFETY AND WELFARE OF THE PUBLIC FOR NORMAL ACTIVITIES AND EMERGENCY EGRESS FROM THE WORK. THE CONTRACTOR(S) SHALL FURNISH AND INSTALL ANY TEMPORARY WALLS, DOORS, HARDWARE PARTITIONS, SCREENS, ENCLOSURES AND PEDESTRIAN PROTECTIONS TO MAINTAIN SUCH LEGAL EGRESS.

F CONTRACTOR(S) SHALL VERIFY ALL DIMENSIONS AND CLEARANCES BEFORE PROCEEDING WITH THE WORK. COMMENCEMENT OF THE WORK, BY THE CONTRACTOR(S), CONSTITUTES ACCEPTANCE OF THE EXISTING CONDITIONS. CONTRACTOR(S) SHALL NOTIFY THE CONSTRUCTION MANAGER IMMEDIATELY OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.

G ALL CIP CONCRETE CURBS AND EQUIPMENT PADS SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR RESPONSIBLE FOR THE ASSOCIATED WORK.

H ALL DIMENSIONS ARE MEASURED TO THE FACE OF MASONRY OR THE FACE OF STUD UNLESS NOTED OR DETAILED OTHERWISE.

I FILL IN ALL MASONRY VOIDS WITH MORTAR OR GROUT WHERE MASONRY ANCHORS OCCUR.

J ALL CMU'S THAT DO NOT LAY OUT IN FULL OR HALF BLOCK LENGTHS SHALL BE BALANCED SUCH THAT PIECES SHALL HAVE NO LESS THAN 4" EXPOSED TO VIEW.

K ALL CMU CORNERS, HORIZONTAL OR VERTICAL, SHALL BE BULLNOSE UNLESS NOTED OR DETAILED OTHERWISE.

L BOTH EXTERIOR AND INTERIOR CMU WORK SHALL BE RUNNING BOND UNLESS NOTED OR DETAILED OTHERWISE.

M SINGLE WYTHE WALLS ARE INDICATED IN ACTUAL DIMENSIONS UNLESS NOTED OR DETAILED OTHERWISE.

N INTERIOR FINISHES SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LOCAL BUILDING CODE AUTHORITY HAVING JURISDICTION OVER THE WORK, AS WELL AS ALL APPLICABLE FEDERAL, STATE AND LOCAL BUILDING CODES AND REGULATIONS.

O THE CONTRACTOR(S) SHALL FURNISH AND INSTALL TREATED WOOD BLOCKING IN WALLS AS REQUIRED TO SECURE ALL EQUIPMENT, ACCESSORIES, HANDRAILS, CASEWORK, ETC. COORDINATE THIS WORK WITH ALL APPROPRIATE CONTRACTORS, SUPPLIERS AND MANUFACTURERS RECOMMENDATIONS. SUCH WOOD BLOCKING SHALL BE FASTENED TO STRUCTURAL MEMBERS AND CMU(S) WITH MINIMUM 1/2" DIAMETER EXPANSION BOLTS AT 48" OC MAXIMUM UNLESS NOTED OR DETAILED OTHERWISE.

P THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ELECTRICAL WALL BOXES IN PLAIN-FACE CMU(S), FURNISHED AND INSTALLED BY THE GENERAL TRADES CONTRACTOR, AS OPPOSED TO SPLIT-FACE, SOUND-ABSORBING, OR SOUND-DIFFUSING CMU(S). THE GENERAL TRADES CONTRACTOR SHALL COORDINATE SUCH EXACT LOCATIONS WITH THE ELECTRICAL CONTRACTOR. NOTIFY THE ARCHITECT OF THOSE LOCATIONS BEFORE PROCEEDING WITH THE WORK.

Q THE GENERAL TRADES CONTRACTOR IS REQUIRED TO CUT AND PATCH ANY OPENINGS LARGER THAN 8" AS REQUIRED FOR ANY FOOD SERVICE, PLUMBING, MECHANICAL, ELECTRICAL AND FIRE PROTECTION CONTRACTOR(S) TO FURNISH AND INSTALL THEIR WORK. CUTTING AND PATCHING INCLUDING CUTTING FLOOR AND/OR WALL, EXCAVATING, BACK FILLING, PATCHING AND REPAIR AS REQUIRED TO MATCH EXISTING ADJACENT SURFACE TO ACCEPT NEW FINISH. REFERENCE ENGINEERING DRAWINGS FOR LOCATIONS OF WORK TO BE PERFORMED. THIS INCLUDES ALL AREAS NOT SPECIFICALLY NOTED BUT REQUIRING CUTTING AND PATCHING.

R REFERENCE CODE PLANS, FLOOR PLANS, REFLECTED CEILING PLANS AND WALL SECTIONS FOR RATED ASSEMBLIES.

S OPENINGS IN ROOF FOR ROOFTOP EQUIPMENT SHALL BE CUT BY THE ROOFING CONTRACTOR. THE ASSOCIATED CONTRACTOR SHALL COORDINATE LOCATIONS OF SUCH OPENINGS WITH THE ROOFING CONTRACTOR. EQUIPMENT CURBS ARE TO BE FURNISHED BY THE ASSOCIATE CONTRACTOR AND INSTALLED BY THE ROOFING CONTRACTOR.

T REFERENCE MECHANICAL DRAWINGS FOR ALL FLUE LOCATIONS. COORDINATE LOCATIONS OF SUCH PENETRATIONS WITH THE CONTRACTOR(S).

U THE CONTRACTOR SHALL PROTECT ALL ROOF DRAINS, SCUPPERS AND DOWNSPOUTS FROM DEBRIS CREATED DURING DEMOLITION AND CONSTRUCTION. THE CONTRACTOR SHALL INSPECT AND CLEAR ALL ROOF DRAINS, SCUPPERS AND DOWNSPOUTS PRIOR TO THE COMPLETION OF THE WORK AND TO ENSURE THAT ALL ROOF DRAINS, SCUPPERS AND DOWNSPOUTS ARE FREE OF DEBRIS AND ARE FUNCTIONING PROPERLY AT PROJECT COMPLETION.

V ALL TYPICAL ROOFING DETAILS ARE SHOWN FOR GENERAL INFORMATION. ALL FINAL FLASHING CONDITIONS SHALL MEET THE APPROVAL OF THE ROOFING MANUFACTURER. ALL DETAIL MODIFICATIONS MUST HAVE SHOP DRAWING APPROVAL.

W INSTALL ALL FLASHING AND APPROPRIATE CRICKETS FOR ALL ROOFTOP PENETRATIONS.

X ALL TOP OF STEEL AND TOP OF BOND BEAM ELEVATIONS SHOWN ON THE ARCHITECTURAL DRAWINGS ARE FOR COORDINATION PURPOSE ONLY. IN CASE OF DISCREPANCY BETWEEN ARCHITECTURAL AND STRUCTURAL DRAWINGS, CONTRACTOR(S) SHALL USE THE ELEVATIONS ON THE STRUCTURAL DRAWINGS AND NOTIFY THE CONSTRUCTION MANAGER IMMEDIATELY.

Y IN THE EVENT OF INCONSISTENCIES WITHIN OR BETWEEN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL PROVIDE THE BETTER QUALITY OR GREATER QUALITY OF WORK AND SHALL COMPLY WITH THE STRICTER REQUIREMENTS.

Z BASIC DEFINITIONS: 'FURNISH' SHALL MEAN TO PURCHASE AND DELIVER PRODUCT TO THE SITE READY FOR INSTALLATION; 'INSTALL' SHALL MEAN TO TAKE FURNISHED PRODUCT AND ASSEMBLE, ERECT, SECURE IN PLACE, CONNECT IN OPERATION AS APPLICABLE; 'PROVIDE' SHALL MEAN TO FURNISH AND INSTALL.

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT
JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2023

GARMANN MILLER
MINSTER, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA
Creativgm.com

NEW BUILDING FOR

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11158 OH-38, MILFORD CENTER, OHIO 43045

ISSUANCES/REVISIONS

1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	MLE	JTM

SHEET TITLE:

GENERAL NOTES, ABBREVIATIONS AND SYMBOLS

SHEET NUMBER:

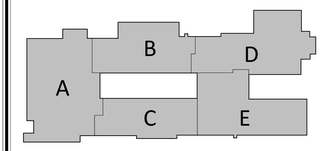
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1 AD5.1 **ROOF DEMOLITION PLAN**
1" = 20'-0"

#	KEYNOTE DESCRIPTION
02 41 00.D9	REMOVE PORTION OF EXISTING BRICK AND CMU AS NEEDED FOR MECHANICAL DUCTWORK. COORDINATE WITH MECHANICAL CONTRACTOR.
02 41 00.G6	REMOVE A PORTION OF THE EXISTING COPING FOR NEW CONCRETE MASONRY UNITS AND STRUCTURAL FRAMING MEMBERS - VERIFY LOCATION IN FIELD.



KEY PLAN

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MINSTER, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
cmorg@gm.com

RENOVATION FOR:

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11158.OH.18, MILFORD CENTER, OHIO 43045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	MLE	JTM

SHEET TITLE:

ROOF DEMOLITION PLAN

SHEET NUMBER:

AD5.1

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ROOF PLAN

1 / A5.1 — 1" = 20'-0"

ROOF PLAN PLAN GENERAL NOTES

A PROVIDE FLASHING IN ACCORDANCE WITH THE SMACNA ARCHITECTURAL SHEET METAL MANUAL LATEST EDITION.

B ALL WOOD BLOCKING AT ROOF PENETRATIONS SHALL BE PRESERVATIVE TREATED.

C PROVIDE CRICKETS WITH TAPERED FLASHING AT MECHANICAL OPENINGS.

D ALL NEW PENETRATIONS AND ALTERATIONS TO EXISTING PENETRATIONS TO BE COMPLETED BY GENERAL CONTRACTOR. COORDINATE EXACT LOCATION AND SCOPE OF WORK WITH DIVISION 23 AND DIVISION 26 CONTRACTORS.

ROOF PLAN SYMBOLS LEGEND

F FLUE DESIGNATION

V VENT DESIGNATION

DIVISIONAL KEYNOTE DESIGNATION - REFERENCE KEYNOTE SCHEDULE AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

XX XX XX.XX.XX
KEYNOTE DESIGNATION
SPECIFICATION SECTION

AREA OF DETAIL — X / XX.X — SIM — CALLOUT
DETAIL NUMBER
SHEET NUMBER

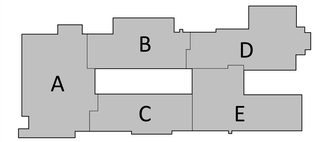
X / XX.X — SIM — SECTION
DETAIL NUMBER
SHEET NUMBER

ROOF PLAN MATERIAL PATTERNS LEGEND

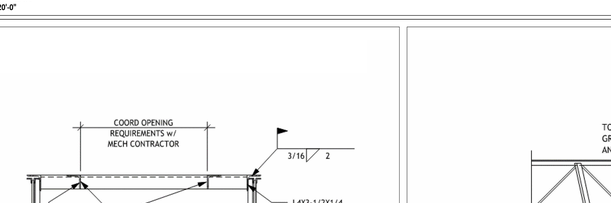
TAPERED INSULATION

PRECAST PLANKS

#	KEYNOTE DESCRIPTION
02 41 00.G4	EXISTING ROOF TO REMAIN
02 41 00.Q2	REMOVE AND REINSTALL EXISTING LOUVER AS REQUIRED.
04 20 00.AE	TOOTH-IN AND PAINT MASONRY AS NEEDED. PAINT TO MATCH EXISTING. COORDINATE WITH MECHANICAL CONTRACTOR.
04 20 00.G3	NOMINAL 8" CONCRETE MASONRY UNIT
05 12 00.L	STRUCTURAL STEEL FRAMING MEMBER - REFERENCE STRUCTURAL DETAILS.
05 52 13.K	TWO RAIL SAFETY GUARDRAIL - EXTEND MINIMUM OF 30 INCHES BEYOND EACH SIDE OF MECHANICAL UNIT. MINIMUM HEIGHT OF 42". REFERENCE SPECIFICATION FOR ADDITIONAL INFORMATION.
05 52 13.L	ATTACH SAFETY GUARDRAIL TO STRUCTURAL BEAM.
06 10 00.F	PRESERVATIVE TREATED WOOD BLOCKING/NAILER
07 21 13.B4	2" BOARD INSULATION
07 21 29.A	SPRAY APPLIED FOAM INSULATION
07 62 00.P	BREAK METAL. COLOR TO MATCH EXTERIOR LOUVER.
09 21 16.A2	5/8" GYPSUM WALLBOARD
23 00 00.A	MECHANICAL EQUIPMENT - REFERENCE MECHANICAL DRAWINGS
23 00 00.F	VERIFY LOCATION OF EXHAUST FAN FOR STRUCTURAL AND MECHANICAL COORDINATION

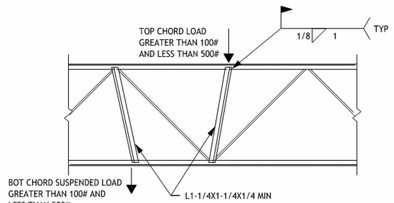


KEY PLAN



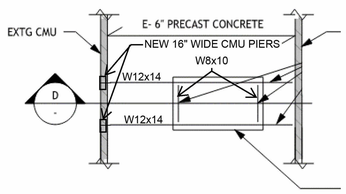
NOTES:
1. SEE MECHANICAL DRAWING FOR LOCATIONS, SIZES, AND QUANTITIES OF ROOF OPENINGS AND CURBS.
2. ALL WELDING TO JOIST TO BE DONE WITH CARE SO AS NOT TO IMPAIR THE STRENGTH OF THE JOIST.

2 / A5.1 STRUCTURAL DETAIL

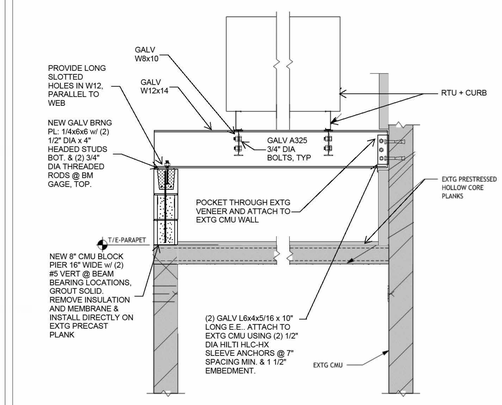


NOTES:
1. CONCENTRATED MECH UNIT LOADS, FOLDING PARTITIONS, SUSPENDED LOADS, ETC., SHOULD BE LOCATED AT JOIST PANEL POINTS WHERE POSSIBLE. WHEN PANEL POINT IS NOT ACCESSIBLE, SUPPORT LOAD AS SHOWN.
2. ALL WELDING TO JOIST IS TO BE DONE WITH CARE AS NOT TO IMPAIR THE STRENGTH OF THE JOIST.

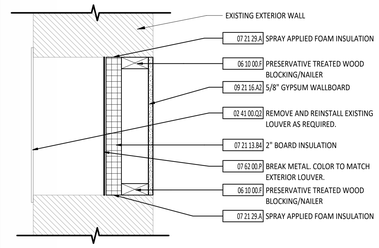
3 / A5.1 STRUCTURAL DETAIL



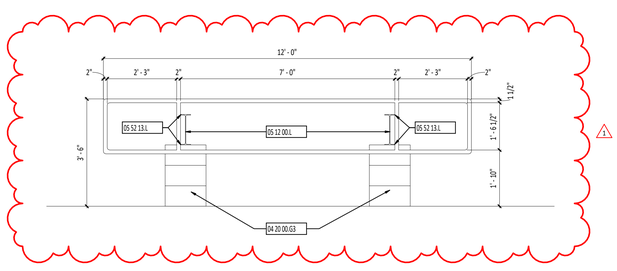
4 / A5.1 PARTIAL ROOF FRAMING DETAIL



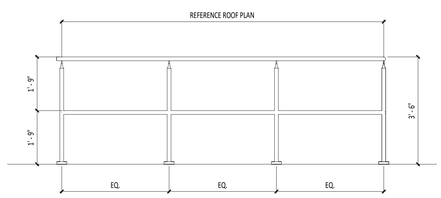
5 / A5.1 STRUCTURAL DETAIL



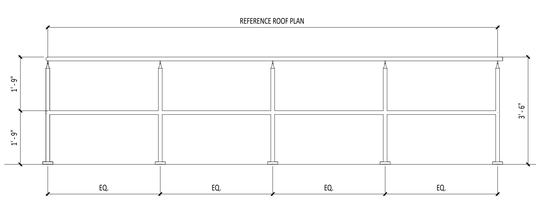
6 / A5.1 MECHANICAL UNIT INFILL
1 1/2" = 1'-0"



7 / A5.1 GUARDRAIL ELEVATION
1/2" = 1'-0"



8 / A5.1 GUARDRAIL ELEVATION
1/2" = 1'-0"



9 / A5.1 GUARDRAIL ELEVATION
1/2" = 1'-0"

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STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MINSTER, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
cmgmgroup.com

RENOVATION FOR:

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11150 OH-38, MILFORD CENTER, OHIO 43045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	MLE	JTM

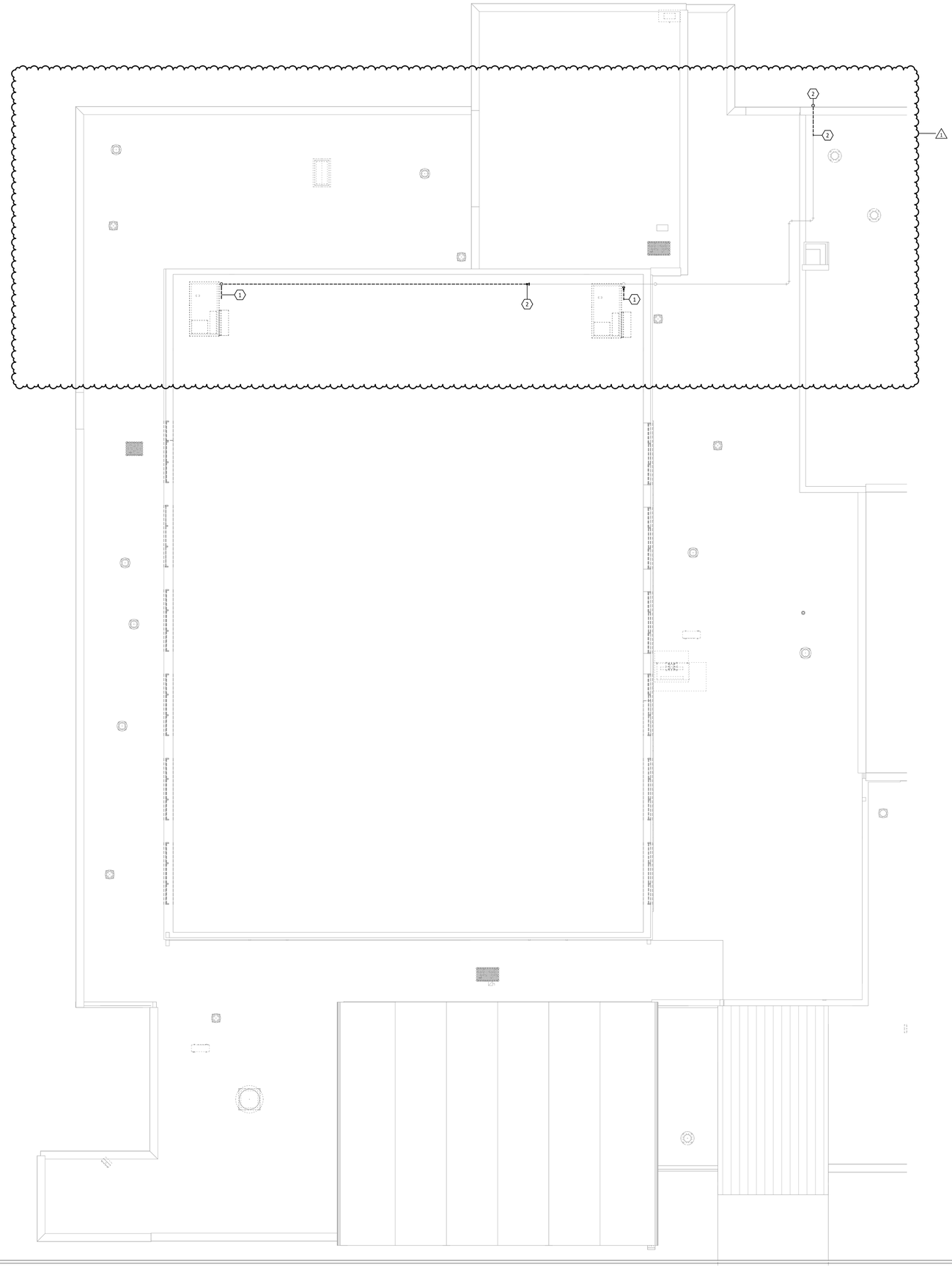
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ROOF PLAN

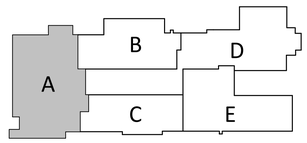
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A5.1

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1 PD1.1 **LEVEL 2 PLUMBING PLAN**
1/8" = 1'-0"



KEY PLAN

PLUMBING DEMOLITION GENERAL NOTES

A ALL EXISTING PIPE SIZES ARE SHOWN BASED ON EXISTING DRAWINGS AND SELECTIVE SITE VERIFICATION. EXACT SIZE, TYPE, AND LOCATION SHALL BE VERIFIED ON SITE PRIOR TO CONSTRUCTION. WHERE CONTRACTOR IS TO CONNECT TO EXISTING, TRANSITIONS SHALL BE PROVIDED AS REQUIRED.

B REMOVAL OF ANY AND ALL PLUMBING SYSTEMS WITH ELECTRICAL CONNECTIONS SHALL BE COORDINATED WITH DIVISION 26 ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED.

C COORDINATE THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, FLOORS, WALLS, ETC. AS REQUIRED FOR PLUMBING DEMOLITION WITH GENERAL CONTRACTOR.

D ANY PLUMBING SYSTEMS REMOVED SHALL BE DISPOSED OF OFF-SITE UNLESS OTHERWISE NOTED.

#	KEYNOTE DESCRIPTION
1	DISCONNECT EXISTING NATURAL GAS PIPING FROM ROOFTOP UNIT. PREPARE PIPING FOR RECONNECTION TO THE NEW ROOFTOP UNIT. REFER TO P2.1 FOR ADDITIONAL INFORMATION. COORDINATE WORK WITH GENERAL CONTRACTOR.
2	EXISTING NATURAL GAS PIPING TO BE REMOVED AND DISPOSED OF OFF SITE TO APPROXIMATE LOCATION SHOWN FOR UPSIZING. PREPARE CUT END FOR RECONNECTION TO NEW PIPING. COORDINATE WORK WITH GENERAL CONTRACTOR.

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MARIETTA, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
(740)748-0100

RENOVATION OF

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11535 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS		
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	ICW	MAK

SHEET TITLE:

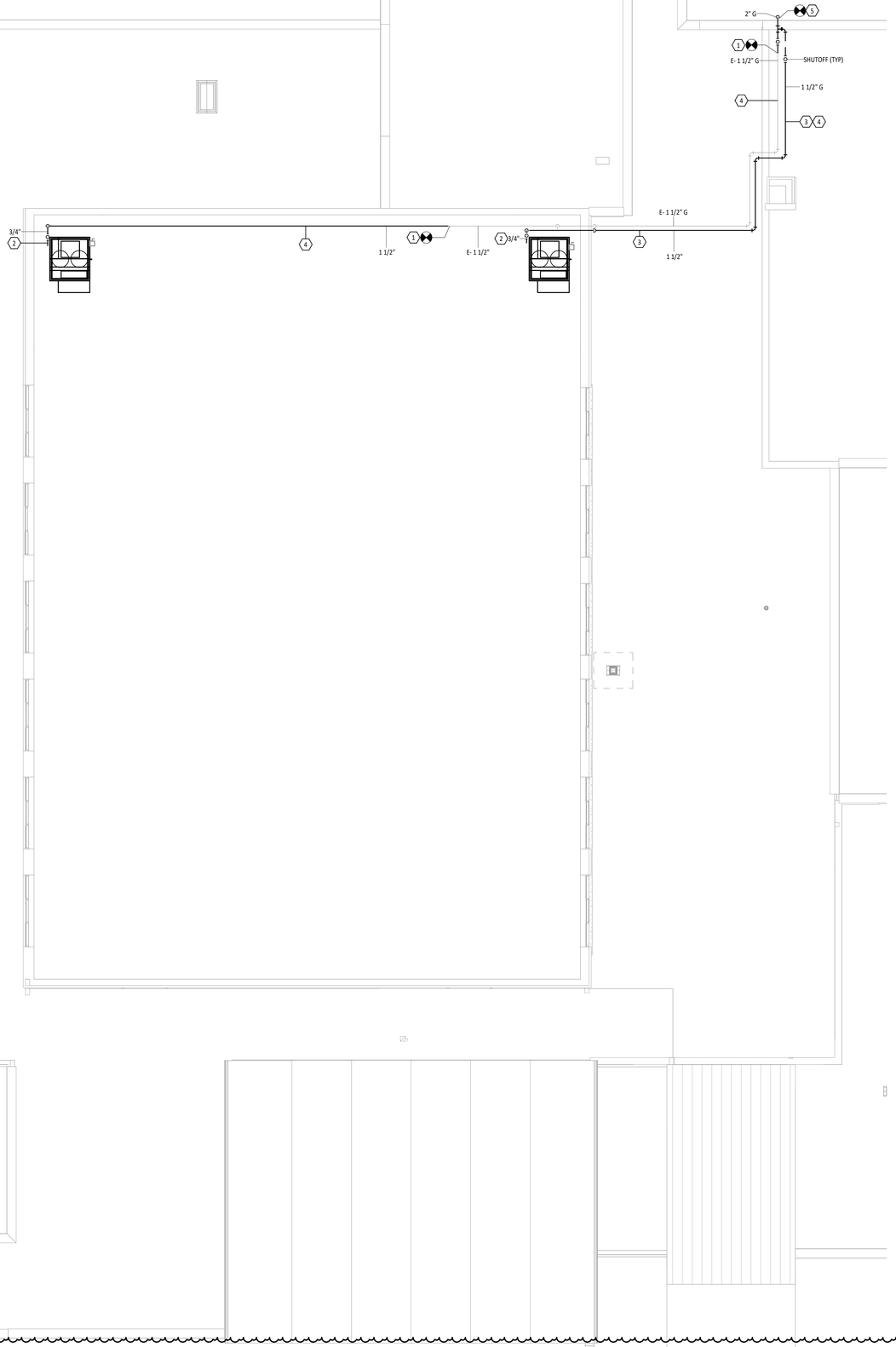
PLUMBING OVERALL DEMOLITION PLAN

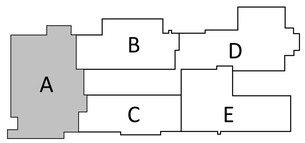
SHEET NUMBER:

PD1.1

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KEY PLAN

2 P2.1 **HIGH SCHOOL GYMNASIUM PLUMBING PLAN**
1/8" = 1'-0"

N

PLUMBING GENERAL NOTES

A PROVIDE TRAP PRIMERS FOR FLOOR DRAINS SERVING MECHANICAL ROOMS, MECHANICAL DECKS, EMERGENCY SHOWERS, KITCHEN FLOOR DRAINS, AND AS REQUIRED BY CODE. SUPPLY NEAREST COLD WATER PIPING CONNECTED TO A FLUSH VALVE OR SOLENOID VALVE. SUPPLY PIPING SHALL BE 1/2" VALVED COLD WATER LINE. REFERENCE DETAIL FOR ADDITIONAL INFORMATION.

B VERIFY INVERT ELEVATIONS ON UNDERGROUND SANITARY AND STORM PIPING. COORDINATE DEPTHS WITH THE BUILDING CONSTRUCTION AND ALL OTHER UTILITIES.

C PITCH UNDERFLOOR SANITARY WASTE AND STORM PIPING 3" AND GREATER AT 1/8" PER FOOT, UNLESS NOTED OTHERWISE. PITCH ALL OTHER WASTE PIPING AT 1/4" PER FOOT UNLESS OTHERWISE NOTED.

D FIELD VERIFY LOCATION AND INVERTS OF SITE UTILITIES PRIOR TO INSTALLATION.

E PROVIDE CLEANOUT IN ACCESSIBLE LOCATION AT THE BASE OF ALL PLUMBING RISERS.

F WHERE FLOOR DRAINS OCCUR WITHIN THE LIMITS OF CONSTRUCTION, PREVENT CONSTRUCTION DEBRIS FROM ENTERING DRAIN BODY BY SEALING DRAIN OPENING PRIOR TO START OF WORK.

G FIRE SEAL AROUND PIPING PENETRATIONS OF FIRE RATED WALLS. REFERERNCE SPECIFICATION.

H PROVIDE SLEEVES AND/OR OPENINGS TO RUN PIPES THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF.

I FIELD VERIFY ALL NEW WATER, WASTE, AND VENT PIPING CONNECTIONS AND PROVIDE NEW CONNECTIONS AS REQUIRED FOR PROPERLY OPERATING SYSTEMS.

J WASTE AND VENT PIPING BELOW FLOOR AND THROUGH FLOOR SHALL BE 2" MINIMUM.

#	KEYNOTE DESCRIPTION
1	CONNECT NEW GAS PIPING TO EXISTING GAS PIPING IN APPROXIMATE LOCATION SHOWN. VERIFY EXACT LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
2	CONNECT GAS PIPING TO NEW ROOFTOP UNIT. PROVIDE DIRT LEG AND SHUTOFF VALVE AT THE CONNECTION POINT. COORDINATE WORK WITH GENERAL CONTRACTOR.
3	NEW GAS PIPING TO BE ROUTED IN A SIMILAR ROUTE TO EXISTING GAS PIPING. VERIFY EXACT ROUTING ON SITE.
4	NEW AND EXISTING GAS PIPING EXPOSED ON THE ROOF TO BE PAINTED WITH THREE COATS OF GREY PROTECTIVE PAINT. COORDINATE WORK WITH GENERAL CONTRACTOR.
5	DIVISION 22 PLUMBING CONTRACTOR TO VERIFY CAPACITY AND OPERATING PRESSURES OF EXISTING NATURAL GAS REGULATOR LOCATED ON THE EXTERIOR OF THE BUILDING. EXISTING REGULATOR MUST HAVE CAPACITY OF AT LEAST 6,050 CFH AT 14 INCHES W.C. ENGINEER TO BE NOTIFIED OF CAPACITY OR PRESSURE ISSUE.

1

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MARIETTA, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
(WWW.GMDESIGN.COM)

RENOVATION OF

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11535 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	CME	ICW

SHEET TITLE:

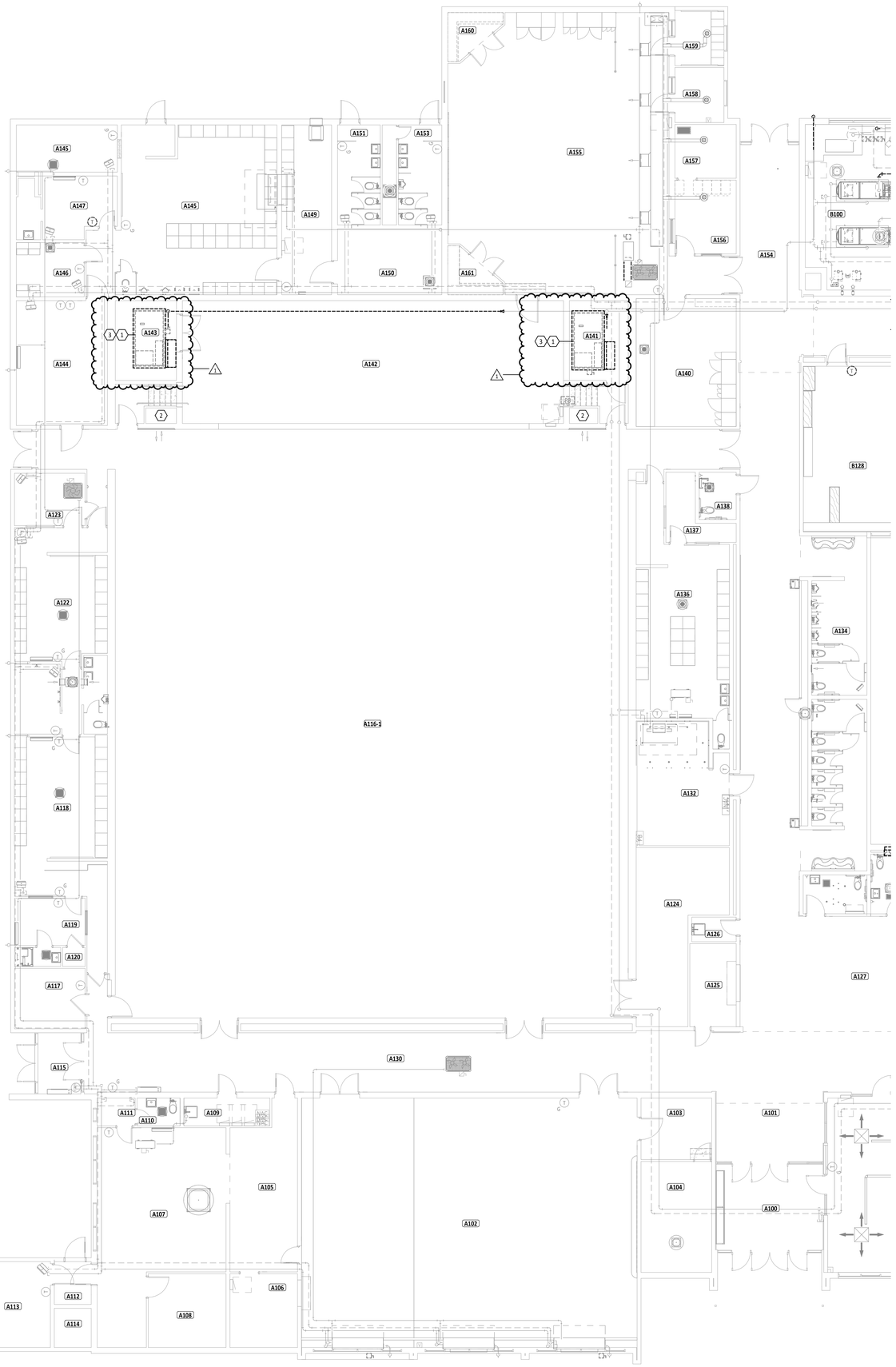
OVERALL PLUMBING PLAN

SHEET NUMBER:

P2.1

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1 MD1.1 **MECHANICAL DEMOLITION PLAN - UNIT A**
1/8" = 1'-0"

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FIRST FLOOR PLAN ROOM INDEX - UNIT A (EXISTING)

ROOM NUMBER	ROOM NAME	AREA
A100	LOBBY	170 SF
A101	CORRIDOR	6,656 SF
A102	STUDENT DINING	2,219 SF
A103	OFFICE	116 SF
A104	STORAGE ROOM	209 SF
A105	SERVING AREA	280 SF
A106	STORAGE ROOM	133 SF
A107	PREPARATION AREA	599 SF
A108	COOLER/ FREEZER	153 SF
A109	ELECTRICAL CLOSET	64 SF
A110	RR	32 SF
A111	LOCKER ROOM	28 SF
A112	VESTIBULE	42 SF
A113	DRY FOOD STORAGE	173 SF
A114	STORAGE	39 SF
A115	VESTIBULE	72 SF
A116	GYMNASIUM	8,241 SF
A117	STORAGE ROOM	114 SF
A118	LOCKER ROOM	419 SF
A119	OFFICE	89 SF
A120	STORAGE	36 SF
A121	RESTROOM AND SHOWER	170 SF
A122	VISITOR LOCKER ROOM	324 SF
A123	STORAGE ROOM	99 SF
A124	PE STORAGE	322 SF
A125	CONCESSIONS	103 SF
A126	CUST CLOSET	29 SF
A128	RR	66 SF
A130	STAFF DINING	60 SF
A133	GIRL'S RESTROOM	1,917 SF
A135	CHASE	43 SF
A136	VOLLEYBALL LOCKER ROOM	487 SF
A137	STORAGE ROOM	76 SF
A138	STORAGE	46 SF
A139	SHOWER	286 SF
A140	INSTRUMENTAL STORAGE	340 SF
A141	PE WORKROOM/ STORAGE	125 SF
A142	STAGE	1,378 SF
A143	STORAGE	130 SF
A144	ATHLETIC TRAINER	303 SF
A145	FOOTBALL LOCKER ROOM	760 SF
A146	STORAGE ROOM	98 SF
A147	COACH'S OFFICE	152 SF
A148	SHOWER	127 SF
A149	STORAGE	225 SF
A150	STORAGE	183 SF
A151	GIRL'S RESTROOM	114 SF
A152	CHASE	39 SF
A153	BOY'S RESTROOM	115 SF
A154	CORRIDOR	361 SF
A155	MUSIC ROOM	1,616 SF
A156	OFFICE	121 SF
A157	STORAGE ROOM	88 SF
A158	STORAGE ROOM	72 SF
A159	UNIFORM STORAGE	72 SF
A160	STORAGE	50 SF
A161	STORAGE	50 SF

HVAC DEMOLITION GENERAL NOTES

A ALL EXISTING DUCTWORK AND PIPING SIZES ARE SHOWN BASED ON EXISTING DRAWINGS AND SELECTIVE SITE VERIFICATION. EXACT SIZE, TYPE, AND LOCATION SHALL BE VERIFIED ON SITE PRIOR TO CONSTRUCTION. WHERE CONTRACTOR IS TO CONNECT TO EXISTING,TRANSITIONS SHALL BE PROVIDED AS REQUIRED.

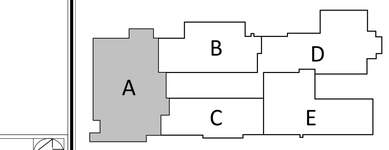
B REMOVAL OF ANY AND ALL MECHANICAL SYSTEMS WITH ELECTRICAL CONNECTIONS SHALL BE COORDINATED WITH DIVISION 26 ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED. DIVISION 26 ELECTRICAL CONTRACTOR TO DISCONNECT ALL HIGH VOLTAGE WIRING. DIVISION 23 MECHANICAL CONTRACTOR TO DISCONNECT ALL LOW VOLTAGE WIRING.

C COORDINATE THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, WALLS, ETC. AS REQUIRED FOR MECHANICAL DEMOLITION WITH GENERAL CONTRACTOR.

D ANY MECHANICAL SYSTEMS REMOVED SHALL BE DISPOSED OF OFF-SITE UNLESS OTHERWISE NOTED.

E UNDER ALTERNATE BID #04: ALL HYDRONIC AND STEAM PIPING THAT IS ACCESSIBLE IN THE CRAWL SPACES SHALL BE DEMOLISHED, REMOVED, AND DISPOSED OFF SITE. PIPING THAT LEAVES THE CRAWL SPACE TO UNDER FLOOR IN TILE SLEEVE TO BE CUT, CAPPED, AND ABANDONED IN PLACE. VERIFY EXACT SIZE AND LOCATION ON SITE.

#	KEYNOTE DESCRIPTION
1	EXISTING ROOFTOP UNITS TO BE DISCONNECTED, REMOVED, AND DISPOSED OF OFF SITE. PREPARE OPENING FOR REINSTALLATION OF NEW ROOFTOP UNITS IN THE SAME LOCATION. REFER TO M2.1 AND M5.2 FOR ADDITIONAL INFORMATION.
2	EXISTING DUCTWORK LOCATED IN CHASE AND GRILLES LOCATED IN SPACE TO REMAIN. PROTECT DURING CONSTRUCTION. PREPARE DUCTWORK FOR RECONNECTION TO NEW ROOFTOP UNIT. VERIFY CONDITION OF DUCTWORK AND ACOUSTIC INSULATION PRIOR TO RECONNECTION. REPLACE ANY DAMAGED DUCTWORK AND INSULATION.
3	THERMOSTATS AND CONTROLS ACCESSORIES LOCATED WITHIN DUCTWORK TO BE REMOVED AND DISPOSED OF OFF SITE. VERIFY EXACT LOCATION ON SITE.



KEY PLAN

STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
CANTON, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
mmhgroup.com

RENOVATION OF
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11158 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

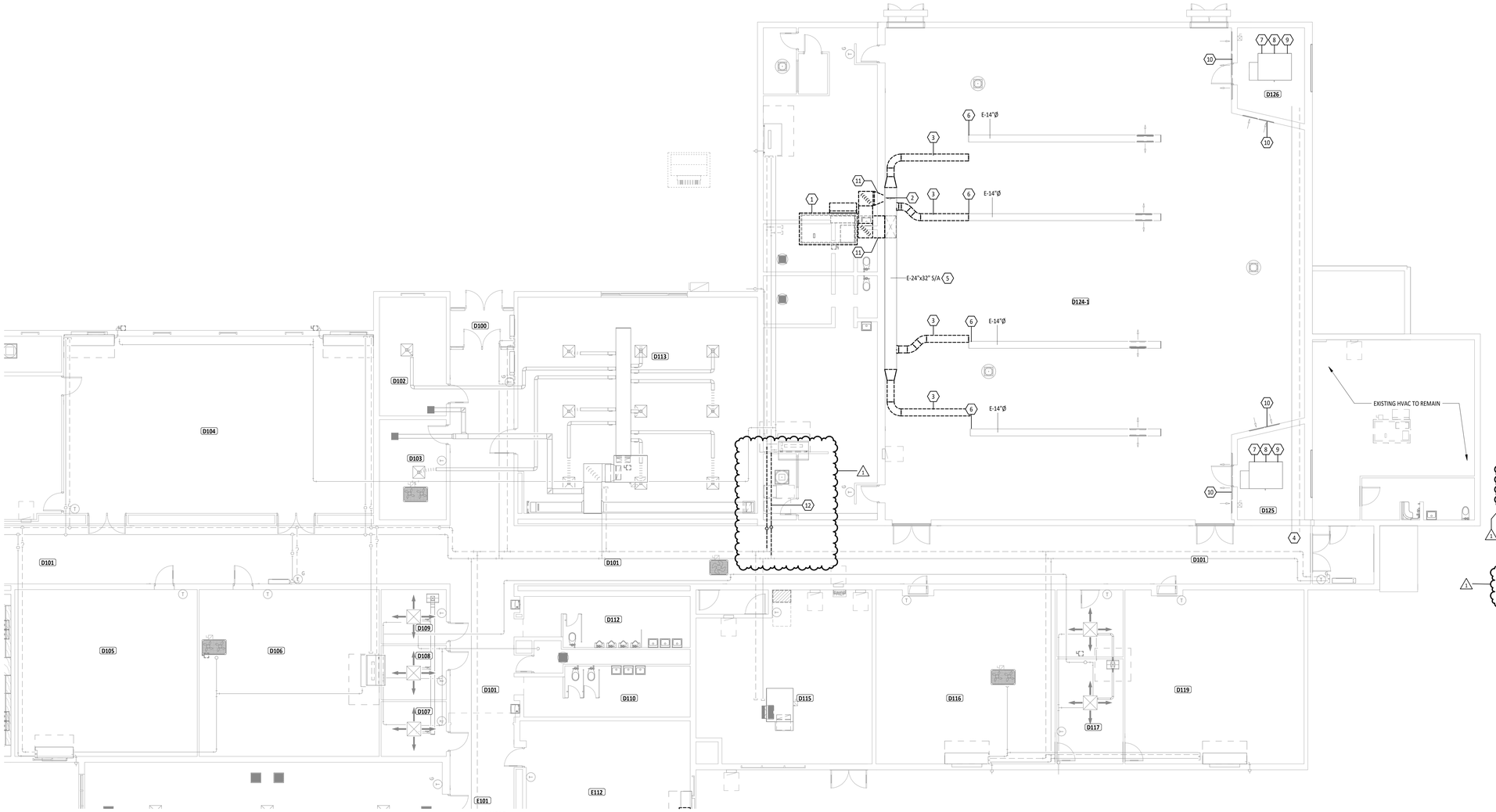
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	CME	ICW

SHEET TITLE:
MECHANICAL DEMOLITION PLAN - UNIT A

SHEET NUMBER:
MD1.1

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FIRST FLOOR PLAN ROOM INDEX - UNIT A (EXISTING)

ROOM NUMBER	ROOM NAME	AREA
D100	VEST	69 SF
D102	RECEPTION/ SECRETARIAL AREA	220 SF
D103	PRINCIPAL'S OFFICE	186 SF
D104	STUDENT DINING	1,527 SF
D106	MIDDLE SCHOOL CLASSROOM	846 SF
D107	MIDDLE SCHOOL CLASSROOM	835 SF
D108	OFFICE	99 SF
D109	GUIDANCE OFFICE	98 SF
D110	OFFICE	98 SF
D111	GIRL'S RESTROOM	223 SF
D112	CHASE	79 SF
D113	BOY'S RESTROOM	223 SF
D114	MIDDLE SCHOOL CLASSROOM	1,432 SF
D115	VESTIBULE	49 SF
D116	MAINTENANCE	774 SF
D117	MIDDLE SCHOOL CLASSROOM	864 SF
D118	OFFICE	195 SF
D119		124 SF
D120	MIDDLE SCHOOL CLASSROOM	864 SF
D121		99 SF
D122		672 SF
D123	LIFE SKILLS LAB	129 SF
D124		159 SF
D125	GYMNASIUM	5,355 SF
D126	STORAGE ROOM	165 SF
D127	STORAGE ROOM	165 SF
D128		650 SF
D129		33 SF
D130		61 SF
D131		687 SF
D132		61 SF

HVAC DEMOLITION GENERAL NOTES

A. ALL EXISTING DUCTWORK AND PIPING SIZES ARE SHOWN BASED ON EXISTING DRAWINGS AND SELECTIVE SITE VERIFICATION. EXACT SIZE, TYPE, AND LOCATION SHALL BE VERIFIED ON SITE PRIOR TO CONSTRUCTION. WHERE CONTRACTOR IS TO CONNECT TO EXISTING,TRANSITIONS SHALL BE PROVIDED AS REQUIRED.

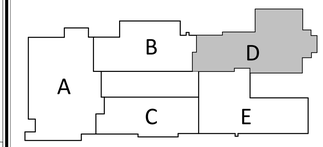
B. REMOVAL OF ANY AND ALL MECHANICAL SYSTEMS WITH ELECTRICAL CONNECTIONS SHALL BE COORDINATED WITH DIVISION 26 ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED. DIVISION 26 ELECTRICAL CONTRACTOR TO DISCONNECT ALL HIGH VOLTAGE WIRING. DIVISION 23 MECHANICAL CONTRACTOR TO DISCONNECT ALL LOW VOLTAGE WIRING.

C. COORDINATE THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, WALLS, ETC. AS REQUIRED FOR MECHANICAL DEMOLITION WITH GENERAL CONTRACTOR.

D. ANY MECHANICAL SYSTEMS REMOVED SHALL BE DISPOSED OF OFF-SITE UNLESS OTHERWISE NOTED.

E. UNDER ALTERNATE BID #04: ALL HYDRONIC AND STEAM PIPING THAT IS ACCESSIBLE IN THE CRAWL SPACES SHALL BE DEMOLISHED, REMOVED, AND DISPOSED OFF SITE. PIPING THAT LEAVES THE CRAWL SPACE TO UNDER FLOOR IN TILE SLEEVE TO BE CUT, CAPPED, AND ABANDONED IN PLACE. VERIFY EXACT SIZE AND LOCATION ON SITE.

#	KEYNOTE DESCRIPTION
1	EXISTING ROOF TOP UNIT SERVING THE GYMNASIUM TO BE DISCONNECTED, REMOVED, AND DISPOSED OF OFFSITE. PREPARE LOCATION FOR INSTALLATION OF NEW ROOFTOP UNIT IN SIMILAR LOCATION. REFER TO M2.4 AND M5.2 FOR ADDITIONAL INFORMATION.
2	EXISTING RETURN GRILLE TO BE REMOVED AND DISPOSED OF OFFSITE. PREPARE OPENING FOR NEW GRILLE AND DUCTWORK SIZE. REFER TO M2.2 AND M5.2 FOR ADDITIONAL INFORMATION.
3	EXISTING SUPPLY AIR DUCTWORK TO BE REMOVED TO APPROXIMATE LOCATION SHOWN. PREPARE EXISTING TO REMAIN DUCTWORK FOR RECONNECTION TO NEW DUCTWORK. REFER TO M2.2 FOR ADDITIONAL INFORMATION.
4	DISCONNECT HYDRONIC PIPING FROM MAIN AT APPROXIMATE LOCATION SHOWN. HYDRONIC PIPING TO BE DRAINED, CAPPED, SEALED, AND ABANDONED IN PLACE. COORDINATE WORK WITH GENERAL CONTRACTOR.
5	EXISTING DUCTWORK EXPOSED ALONG WALL TO REMAIN. VERIFY EXACT SIZE OF DUCTWORK BEFORE CONSTRUCTION. ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES WITH INDICATED SIZE. REFER TO M2.2 FOR ADDITIONAL INFORMATION.
6	EXISTING DUCTWORK AFTER INDICATED DEMOLITION LOCATION AND SUPPLY DIFFUSERS EXPOSED ABOVE TO REMAIN. VERIFY EXACT SIZE OF DUCTWORK BEFORE CONSTRUCTION. ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES WITH INDICATED SIZE. REFER TO M2.2 FOR ADDITIONAL INFORMATION.
7	EXISTING AIR HANDLER TO BE ABANDONED IN PLACE. DIVISION 23 MECHANICAL CONTRACTOR TO DISCONNECT HYDRONIC PIPING. PIPING TO BE DRAINED, CAPPED, AND SEALED. COORDINATE WORK WITH GENERAL CONTRACTOR.
8	EXISTING AIR HANDLER TO BE ABANDONED IN PLACE. DIVISION 23 MECHANICAL CONTRACTOR TO DISCONNECT OUTSIDE AIR DUCTWORK. EXTERIOR WALL LOUVER TO BE CAPPED AND SEALED. WALL LOUVER TO BE FILLED WITH MINIMUM 2" BOARD INSULATION. COORDINATE WORK WITH GENERAL CONTRACTOR.
9	EXISTING AIR HANDLER TO BE ABANDONED IN PLACE. DIVISION 23 MECHANICAL CONTRACTOR TO DISCONNECT POWER. COORDINATE WORK WITH GENERAL CONTRACTOR.
10	EXISTING INTERIOR WALL DIFFUSERS AND GRILLES TO REMAIN.
11	WALL PENETRATIONS TO BE MODIFIED TO ACCOMMODATE NEW DUCTWORK. REFER TO M2.2 FOR ADDITIONAL INFORMATION. COORDINATE MASONRY DEMOLITION AND REPAIR WITH GENERAL CONTRACTOR. (WHERE CASE-IN-PLACE)
12	HYDRONIC PIPING TO BE REMOVED AND DISPOSED OF OFFSITE TO APPROXIMATE LOCATION SHOWN FOR UPSIZING OF BRANCH. PREPARE CUT ENDS FOR RECONNECTION TO NEW PIPING. REFER TO M3.1 FOR ADDITIONAL INFORMATION.



KEY PLAN

1 MD1.2 **MECHANICAL DEMOLITION PLAN - UNIT D**
1/8" = 1'-0"

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STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MARIETTA, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
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RENOVATION OF
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11150 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

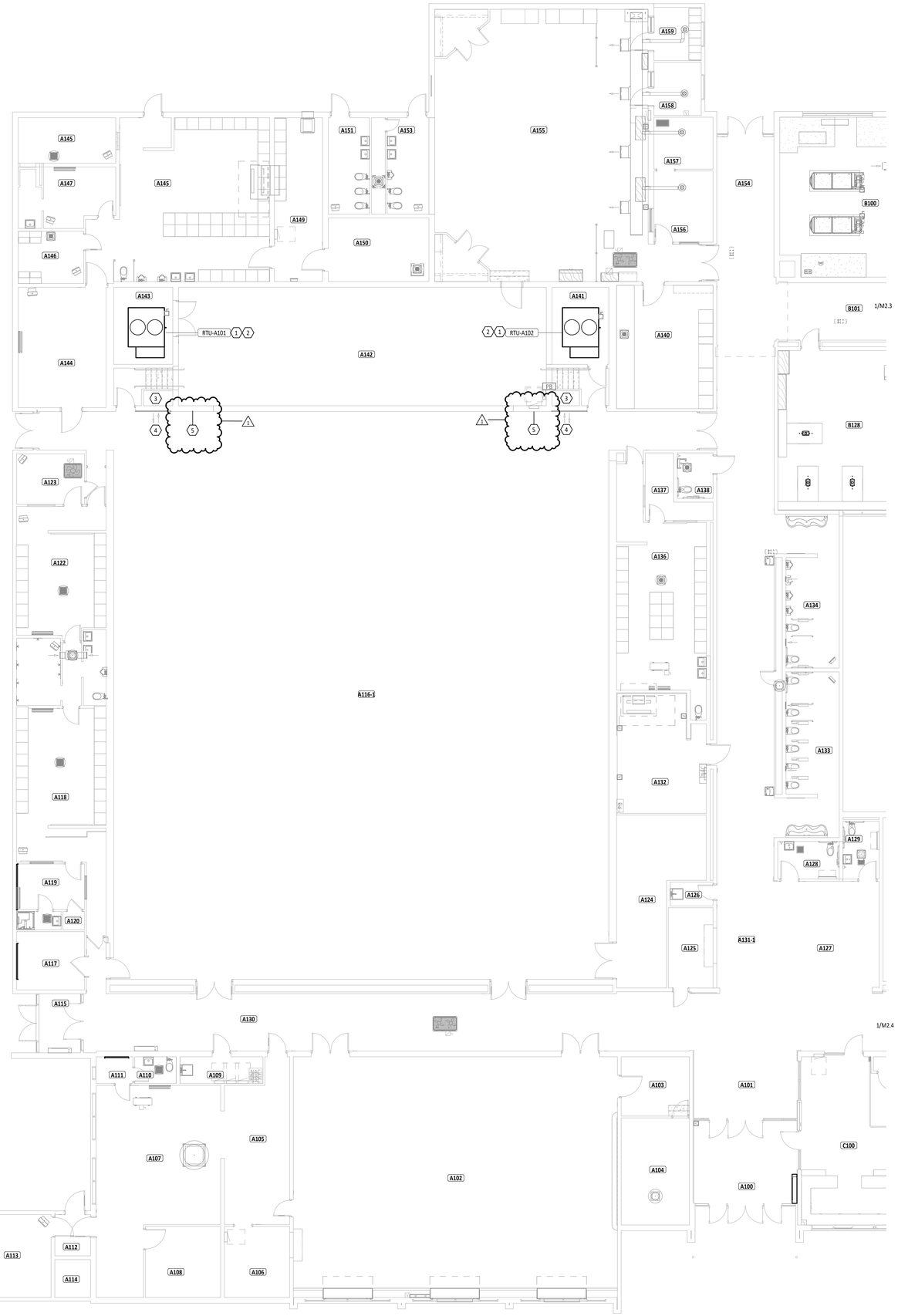
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	CME	ICW

SHEET TITLE:
MECHANICAL DEMOLITION PLAN - UNIT D

SHEET NUMBER:
MD1.2

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1 M2.1 **MECHANICAL PLAN - UNIT A**
1/8" = 1'-0"

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FIRST FLOOR PLAN ROOM INDEX - UNIT A

ROOM NUMBER	ROOM NAME	AREA
A100	VESTIBULE	254 SF
A101	LOBBY	170 SF
A102	STUDENT DINING	2,219 SF
A103	OFFICE	116 SF
A104	STORAGE ROOM	209 SF
A105	SERVING AREA	280 SF
A106	STORAGE ROOM	133 SF
A107	PREPARATION AREA	599 SF
A108	COOLER/ FREEZER	153 SF
A109	ELECTRICAL CLOSET	64 SF
A110	RESTROOM	32 SF
A111	LOCKER ROOM	28 SF
A112	VESTIBULE	42 SF
A113	DRY FOOD STORAGE	173 SF
A114	STORAGE	39 SF
A115	VESTIBULE	72 SF
A116	GYMNASIUM	8,241 SF
A117	STORAGE ROOM	114 SF
A118	LOCKER ROOM	419 SF
A119	OFFICE	89 SF
A120	STORAGE	36 SF
A121	RESTROOM AND SHOWER	170 SF
A122	VISITOR LOCKER ROOM	324 SF
A123	STORAGE ROOM	99 SF
A124	PE STORAGE	322 SF
A125	CONCESSIONS	103 SF
A126	CUST CLOSET	29 SF
A127	LOUNGE	324 SF
A128	FAMILY RESTROOM	66 SF
A129	FAMILY RESTROOM	60 SF
A130	CORRIDOR	1,048 SF
A131	CORRIDOR	1,082 SF
A132	CLASSROOM	286 SF
A133	GIRL'S RESTROOM	259 SF
A134	BOY'S RESTROOM	241 SF
A136	VOLLEYBALL LOCKER ROOM	487 SF
A137	STORAGE ROOM	76 SF
A138	RESTROOM	46 SF
A140	INSTRUMENTAL STORAGE	340 SF
A141	PE WORKROOM/ STORAGE	125 SF
A142	STAGE	1,378 SF
A143	STORAGE	130 SF
A144	ATHLETIC TRAINER	303 SF
A145	FOOTBALL LOCKER ROOM	760 SF
A146	STORAGE ROOM	98 SF
A147	COACH'S OFFICE	152 SF
A148	SHOWER	127 SF
A149	STORAGE	225 SF
A150	STORAGE	183 SF
A151	GIRL'S RESTROOM	114 SF
A152	CHASE	39 SF
A153	BOY'S RESTROOM	115 SF
A154	CORRIDOR	361 SF
A155	MUSIC ROOM	1,616 SF
A156	OFFICE	121 SF
A157	STORAGE	88 SF
A158	OFFICE	72 SF
A159	PRACTICE ROOM	72 SF
A160	UNIFORM STORAGE	50 SF
A161	UNIFORM STORAGE	50 SF

HVAC GENERAL NOTES

A. DIVISION 23 MECHANICAL CONTRACTOR IS REQUIRED TO COORDINATE DIFFUSER AND GRILLE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLANS.

B. ALL EQUIPMENT LOCATED ABOVE CEILING REQUIRING MAINTENANCE SHALL BE INSTALLED WITHIN (2) FEET OF THE CEILING FOR MAINTENANCE PURPOSES. DO NOT INSTALL UNITS ABOVE LIGHTS AND CEILING SPEAKERS. COORDINATE LOCATION WITH ARCHITECTURAL REFLECTED CEILING PLAN AND GENERAL CONTRACTOR.

C. ANY BALANCING DAMPERS OR OTHER DEVICES IN DUCTS ABOVE HARD CEILINGS SHALL BE LOCATED ABOVE NEAREST ACCESSIBLE CEILING.

D. THIS CONTRACTOR SHALL BE REQUIRED TO REPLACE FILTERS ON HVAC EQUIPMENT AFTER ALL DUST PRODUCING CONSTRUCTION HAS BEEN COMPLETED AND PRIOR TO THE FINAL PUNCH.

E. ALL ROOF MOUNTED EQUIPMENT SHALL BE A MINIMUM 10'-0" FROM EDGE OF ROOF.

F. LOCATE DUCTWORK AND MECHANICAL EQUIPMENT AWAY FROM THE SPACE ABOVE ELECTRICAL PANELS. TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT.

G. FIRE SEAL AROUND DUCT PENETRATIONS OF FIRE RATED WALLS. REFER TO SPECIFICATION.

H. PROVIDE SLEEVES AND/OR OPENINGS TO RUN DUCTS THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF.

I. DIVISION 23 MECHANICAL CONTRACTOR IS REQUIRED TO COORDINATE DIFFUSER AND GRILLE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLANS.

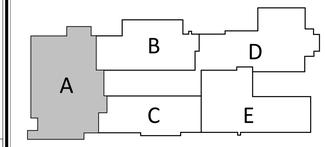
J. CONTRACTOR SHALL LOCATE THERMOSTATS AND TEMPERATURE SENSORS AT 3'-8" AFF, A MINIMUM OF 4" FROM LIGHT SWITCH.

K. CONDENSATE DRAINS SHALL BE SUPPLIED FOR ALL COOLING EQUIPMENT. CONTRACTOR SHALL ENSURE PROPER INSTALLATION AND DRAINAGE AS REQUIRED BY FEDERAL, STATE, AND LOCAL CODES. CONDENSATE PIPING SHALL BE TYPE "L" COPPER.

L. ALL SUPPLY, RETURN, AND EXHAUST DUCTWORK SHALL BE RATED FOR PRESSURE CLASS OF 2" W.G. UNLESS NOTED OTHERWISE.

M. THIS CONTRACTOR SHALL BE REQUIRED TO REPLACE FILTERS ON HVAC EQUIPMENT AFTER ALL DUST PRODUCING CONSTRUCTION HAS BEEN COMPLETED AND PRIOR TO THE SUBSTANTIAL COMPLETION.

#	KEYNOTE DESCRIPTION
1	NEW ROOFTOP UNIT TO BE INSTALLED IN APPROXIMATE LOCATION SHOWN. PROVIDE ROOF CURB ADAPTER AS NECESSARY FOR INSTALLATION. EXISTING ROOF CURB TO BE MEASURED BEFORE ORDERING/FABRICATION OF CURB ADAPTER. COORDINATE NATURAL GAS AND POWER RECONNECTION WITH OTHER DISCIPLINES AND GENERAL CONTRACTOR.
2	RECONNECT DUCTWORK TO NEW ROOFTOP UNIT. SIZE AND CONDITION OF EXISTING DUCTWORK TO BE VERIFIED BEFORE REINSTALLATION.
3	EXISTING SUPPLY AND RETURN DUCTWORK TO BE CLEANED ACCORDING TO SPECIFICATION SECTION 23 31 00. COORDINATE WORK WITH GENERAL CONTRACTOR.
4	EXISTING CURB/OPENING SHALL BE RELOCATED AS NEEDED.
5	APPROXIMATE LOCATION OF MECHANICAL CONTROL DEVICE FOR ROOFTOP UNIT. SURFACE MOUNTED RACEWAY TO BE PAINTED TO MATCH WALL COLOR IN LOCATION. COORDINATE WORK WITH GENERAL CONTRACTOR. REFER TO M6.1 FOR ADDITIONAL INFORMATION.



KEY PLAN

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MANSFIELD, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
(419)782-0101

RENOVATION OF
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11505 S.R. 38, Milford Center, Ohio 43045

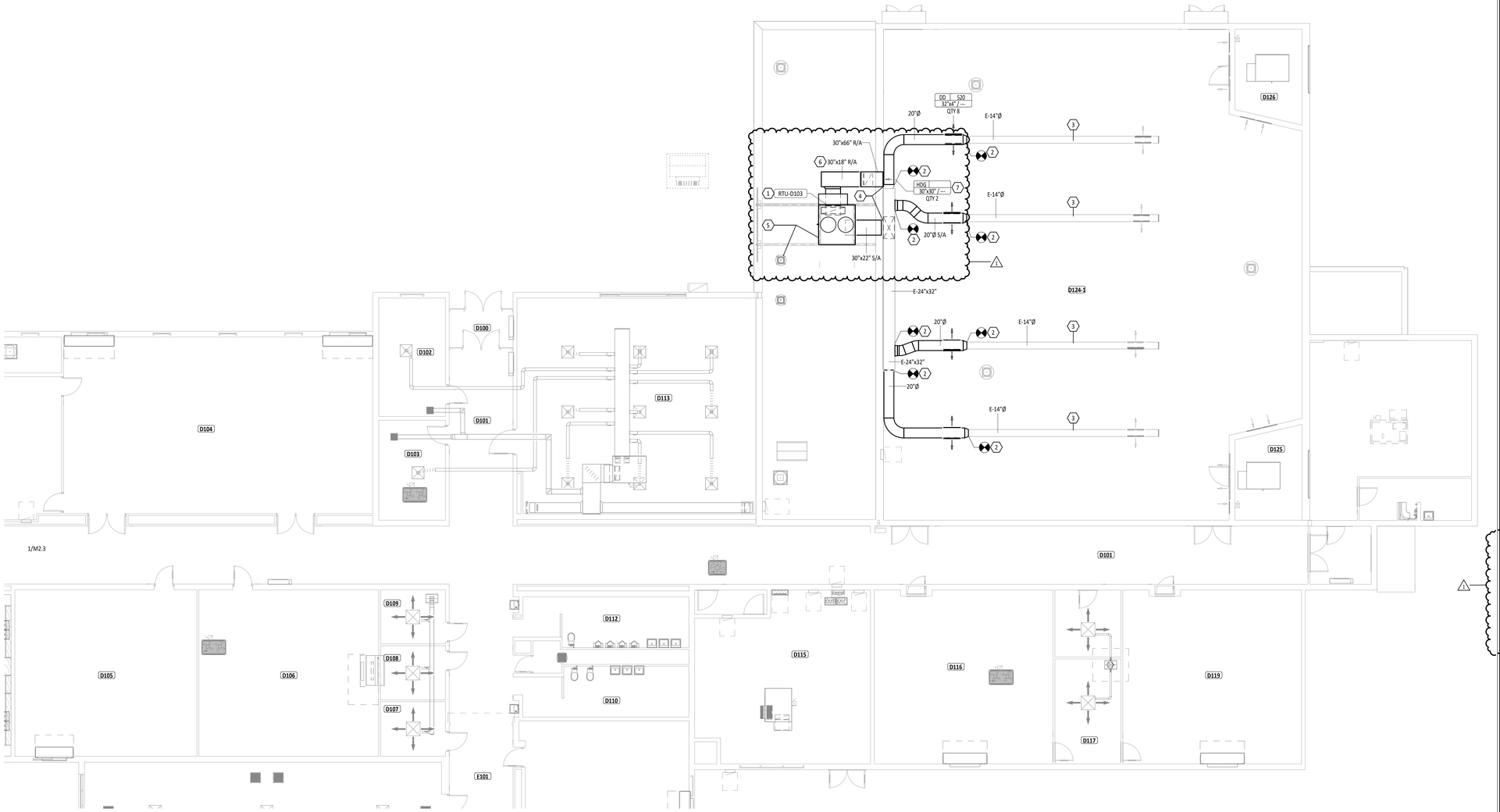
ISSUANCES/REVISIONS		
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	CME	ICW

SHEET TITLE:
MECHANICAL PLAN - UNIT A

SHEET NUMBER:
M2.1

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FIRST FLOOR PLAN ROOM INDEX - UNIT D		
ROOM NUMBER	ROOM NAME	AREA
D100	VESTIBULE	69 SF
D101	CORRIDOR	3,003 SF
D102	RECEPTION/ SECRETARIAL AREA	220 SF
D103	PRINCIPAL'S OFFICE	186 SF
D104	STUDENT DINING	1,527 SF
D105	MIDDLE SCHOOL CLASSROOM	846 SF
D106	MIDDLE SCHOOL CLASSROOM	835 SF
D107	OFFICE	99 SF
D108	OFFICE	98 SF
D109	OFFICE	98 SF
D110	GIRL'S RESTROOM	223 SF
D111	CHASE	79 SF
D112	BOY'S RESTROOM	223 SF
D113	MIDDLE SCHOOL LAB CLASSROOM	1,432 SF
D114	VESTIBULE	49 SF
D115	MAINTENANCE	774 SF
D116	MIDDLE SCHOOL CLASSROOM	864 SF
D117	OFFICE/ WORKROOM	195 SF
D118	OFFICE	124 SF
D119	MIDDLE SCHOOL CLASSROOM	864 SF
D120	VESTIBULE	99 SF
D121	LIFE SKILLS LAB	672 SF
D122	LIFE SKILLS LAB	129 SF
D123	GARAGE	159 SF
D124	GYMNASIUM	5,355 SF
D125	STORAGE ROOM	165 SF
D126	STORAGE ROOM	165 SF
D127	LOCKER ROOM	650 SF
D128	STORAGE	33 SF
D129	STORAGE	61 SF
D130	LOCKER ROOM	687 SF
D131	STORAGE	61 SF

HVAC GENERAL NOTES

A DIVISION 23 MECHANICAL CONTRACTOR IS REQUIRED TO COORDINATE DIFFUSER AND GRILLE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLANS.

B ALL EQUIPMENT LOCATED ABOVE CEILING REQUIRING MAINTENANCE SHALL BE INSTALLED WITHIN (2) FEET OF THE CEILING FOR MAINTENANCE PURPOSES. DO NOT INSTALL UNITS ABOVE LIGHTS AND CEILING SPEAKERS. COORDINATE LOCATION WITH ARCHITECTURAL REFLECTED CEILING PLAN AND GENERAL CONTRACTOR.

C ANY BALANCING DAMPERS OR OTHER DEVICES IN DUCTS ABOVE HARD CEILINGS SHALL BE LOCATED ABOVE NEAREST ACCESSIBLE CEILING.

D THIS CONTRACTOR SHALL BE REQUIRED TO REPLACE FILTERS ON HVAC EQUIPMENT AFTER ALL DUST PRODUCING CONSTRUCTION HAS BEEN COMPLETED AND PRIOR TO THE FINAL PUNCH.

E ALL ROOF MOUNTED EQUIPMENT SHALL BE A MINIMUM 10'-0" FROM EDGE OF ROOF.

F LOCATE DUCTWORK AND MECHANICAL EQUIPMENT AWAY FROM THE SPACE ABOVE ELECTRICAL PANELS. TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT.

G FIRE SEAL AROUND DUCT PENETRATIONS OF FIRE RATED WALLS. REFER TO SPECIFICATION.

H PROVIDE SLEEVES AND/OR OPENINGS TO RUN DUCTS THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF.

I DIVISION 23 MECHANICAL CONTRACTOR IS REQUIRED TO COORDINATE DIFFUSER AND GRILLE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLANS.

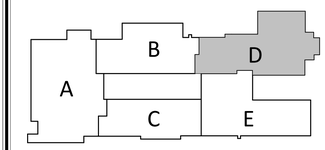
J CONTRACTOR SHALL LOCATE THERMOSTATS AND TEMPERATURE SENSORS AT 3'-8" AFF, A MINIMUM OF 4" FROM LIGHT SWITCH.

K CONDENSATE DRAINS SHALL BE SUPPLIED FOR ALL COOLING EQUIPMENT. CONTRACTOR SHALL ENSURE PROPER INSTALLATION AND DRAINAGE AS REQUIRED BY FEDERAL, STATE, AND LOCAL CODES. CONDENSATE PIPING SHALL BE TYPE "L" COPPER.

L ALL SUPPLY, RETURN, AND EXHAUST DUCTWORK SHALL BE RATED FOR PRESSURE CLASS OF 2" W.G. UNLESS NOTED OTHERWISE.

M THIS CONTRACTOR SHALL BE REQUIRED TO REPLACE FILTERS ON HVAC EQUIPMENT AFTER ALL DUST PRODUCING CONSTRUCTION HAS BEEN COMPLETED AND PRIOR TO THE SUBSTANTIAL COMPLETION.

#	KEYNOTE DESCRIPTION
1	NEW ROOFTOP UNIT TO BE INSTALLED IN APPROXIMATE LOCATION SHOWN ON NEW STEEL STRUCTURE. DUCTWORK AT UNIT TO BE ROUTED THROUGH STRUCTURE AS NEEDED FOR RECONNECTION. COORDINATE POWER RECONNECTION WITH OTHER DISCIPLINES AND GENERAL CONTRACTOR.
2	CONNECT TO THE EXISTING DUCTWORK. VERIFY DUCT SIZE ON SITE. ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES IN DUCTWORK SIZING.
3	EXISTING SUPPLY DUCTWORK TO BE CLEANED ACCORDING TO SPECIFICATION SECTION [illegible]
4	DUCTWORK TO REUSE EXISTING PENETRATION IN WALL. PENETRATION TO BE MODIFIED AS NEEDED TO ACCOMMODATE NEW DUCTWORK SIZE. COORDINATE WORK WITH GENERAL CONTRACTOR. VERIFY EXACT SIZE AND LOCATION ON SITE.
5	COORDINATE EXACT LOCATION OF NEW ROOFTOP UNIT ON SITE. ROOFTOP UNIT OUTSIDE AIR INTAKE TO NOT BE LESS THAN 10'-0" AWAY FROM EXISTING ROOFTOP EXHAUST FAN IN APPROXIMATE LOCATION. COORDINATE NEW STRUCTURE LOCATION WITH GENERAL CONTRACTOR.
6	PROVIDE 1" ACOUSTICAL LINER IN RETURN DUCT FROM RTU. DUCT SIZE/DIMENSIONS SHOWN IS FREE AREA REQUIRED AND DOES NOT INCLUDE THE LINER. ALL LINED DUCT AND FITTINGS SHALL BE DOUBLE-WALLED WITH PERFORATED INTERIOR.
7	NEW WALL MOUNTED RETURN GRILLE TO MATCH COLOR OF WALL. COORDINATE WORK WITH GENERAL CONTRACTOR.



KEY PLAN

1 M2.2 MECHANICAL PLAN - UNIT D
1/8" = 1'-0"

N

PRINTED ON: 10/12/2026 2:15:00 PM

STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MARIETTA, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
(GARMANNMILLER.COM)

RENOVATION OF
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11150 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	CME	ICW

SHEET TITLE:
MECHANICAL PLAN - UNIT D

SHEET NUMBER:
M2.2

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GAS-FIRED ROOFTOP UNIT SCHEDULE

ID	MANUFACTURER	MODEL NO.	TYPE	ARRANGEMENT	SUPPLY AIRFLOW	OUTSIDE AIR			FAN					INCLUDE POWER EXHAUST	COOLING COIL						INCLUDE ECONOMIZER	INCLUDE HGR	GAS-FIRED HX				COMPRESSOR			FILTER	UNIT WEIGHT	VOLT	PH	REMARKS
									PRESS	DRIVE	MOTOR				NOMINAL CAP	CAP	AIRSIDE						GAS BURNER			AIRSIDE			REFRIGERANT		LOW AMBIENT KIT	IEER	EER					
						DESIGN	MIN	DCV	ESP	TYPE	QTY	POWER	ECM			TOTAL	SENSIBLE	EAT(db)	EAT(wb)	LAT(db)	LAT(wb)			INPUT	STAGES	TYPE / PRESS AVAIL	EAT(db)	LAT(db)	TYPE	CHARGE				EFF			
RTU-A101	DAIKIN APPLIED	DPSC12B	GAS-FIRED, DX-COIL	BOTTOM SUPPLY, BOTTOM RETURN	6000 CFM	2050 CFM	1585 CFM	Yes	1.00 in-wg	DIRECT	1	6.1 hp	Yes	Yes	12.0 ton	157300 Btu/h	142071 Btu/h	79.9 °F	65.9 °F	57.3 °F	57.3 °F	Yes	Yes	324000 Btu/h	5	NG / 11.0 in-wg	45.1 °F	94.9 °F	R32	22 lb	Yes	18.4	11.5	COMBO RACK-2" MERV8 & 4" MERV14	2476 lb	460 V	3	1, 2, 3, 4, 5, 6, 7, 8
RTU-A102	DAIKIN APPLIED	DPSC12B	GAS-FIRED, DX-COIL	BOTTOM SUPPLY, BOTTOM RETURN	6000 CFM	2050 CFM	1585 CFM	Yes	1.00 in-wg	DIRECT	1	6.1 hp	Yes	Yes	12.0 ton	157300 Btu/h	142071 Btu/h	79.9 °F	65.9 °F	57.3 °F	57.3 °F	Yes	Yes	324000 Btu/h	5	NG / 11.0 in-wg	45.1 °F	94.9 °F	R32	22 lb	Yes	18.4	11.5	COMBO RACK-2" MERV8 & 4" MERV14	2476 lb	460 V	3	1, 2, 3, 4, 5, 6, 7, 8

1) FULL ECONOMIZER OPTION.
2) INSULATED CURB. INSTALL AND FASTEN CURB PER MANUFACTURER'S REQUIREMENTS
3) BACNET COMMUNICATION CARD.
4) PROVIDED 7-DAY PROGRAMMABLE THERMOSTAT/CO2/HUMIDITY COMBINATION SENSOR.
5) CO2 DEMAND CONTROL VENTILATION CONTROLS
6) FIELD PROVIDED AND INSTALLED CO DETECTOR.
7) FIELD PROVIDED AND INSTALLED SMOKE DUCT DETECTOR
8) FIELD PROVIDED DISCONNECT AND INSTALLED BY DIVISION 26 ELECTRICAL CONTRACTOR

HEAT PUMP AND HYDRONIC ROOFTOP UNIT SCHEDULE (PART 1 OF 2)

ID	MANUFACTURER	MODEL NO.	TYPE	ARRANGEMENT	OUTSIDE AIR			FAN							SECONDARY FAN	COOLING COIL							HOT GAS REHEAT	HEAT PUMP HEATING COIL			
								AIRFLOW		PRESS	DRIVE	MOTOR					CAP	AIRSIDE										
					FLOW	MIN	DCV	DESIGN	MIN	ESP	TYPE	QTY	POWER	RPM	ECM	INCLUDE POWER EXHAUST	NOMINAL CAP	SENSIBLE	EAT(db)	EAT(wb)	LAT(db)	LAT(wb)	FV	INCLUDE	TYPE	CAP	EAT	LAT
RTU-D103	DAIKIN APPLIED	DPSH15B	HOT WATER COIL, DX COIL	BOTTOM SUPPLY, BOTTOM RETURN	2310 CFM	1460 CFM	Yes	6500 CFM	1800 CFM	1.00 in-wg	DIRECT	1	6.1 hp	1750	Yes	Yes	15 ton	160300 Btu/h	80.1 °F	66.1 °F	56.4 °F	56.4 °F	421 FPM	Yes	HEAT PUMP	88595 Btu/h	56.6 °F	69.2 °F

HEAT PUMP AND HYDRONIC ROOFTOP UNIT SCHEDULE (PART 2 OF 2)

ID	MANUFACTURER	MODEL NO.	HOT WATER HEATING WATER COIL							COMPRESSOR					FILTER						EQUIPMENT WEIGHT	REMARKS
				AIRSIDE		WATERSIDE					REFRIGERANT											
			CAP	EAT(db)	LAT(db)	FLOW	EWT	LWT	PD	TYPE	TYPE	CHARGE	SEER	EER	IEER	EFF	FLA	MCA	MOCP	VOLT	PH		
RTU-D103	DAIKIN APPLIED	DPSH15B	205918 Btu/h	56.6 °F	85.6 °F	13.7 GPM	140 °F	110 °F	5.3 ftH2O	INVERTER SCROLL	R32	34 lb	[redacted]	11.6	20.7	COMBO RACK-2" MERV8 & 4" MERV14	43.0 A	49.4 A	70.0 A	460 V	3	2564 lb	1, 2, 3, 4, 5, 6, 7

1) FULL ECONOMIZER OPTION.
2) EXTERNAL HYDRONIC PIPE CABINET.
3) BACNET COMMUNICATION CARD.
4) PROVIDED 7-DAY PROGRAMMABLE THERMOSTAT/CO2/HUMIDITY COMBINATION SENSOR.
5) CO2 DEMAND CONTROL VENTILATION CONTROLS
6) FIELD PROVIDED AND INSTALLED SMOKE DUCT DETECTOR
7) UNIT TO BE MOUNTED ON STRUCTURAL STEEL. PROVIDE CURB AND/OR CURB RAILS FOR MOUNTING.
8) FIELD PROVIDED DISCONNECT AND INSTALLED BY DIVISION 26 ELECTRICAL CONTRACTOR.

GRILLES, REGISTERS AND DIFFUSERS SCHEDULE

ID	DESCRIPTION	MANUFACTURER	MODEL	QTY	FACE SIZE	NECK			BLADE DESIGN					INSTALLATION	NOTES
											DEFLECTION ANGLE				
						SIZE	WIDTH	HEIGHT	THICKNESS	SPACING	SINGLE	DOUBLE	ORIENTATION	BORDER TYPE	
DD	LOUVERED DOUBLE DEFLECTION GRILLE	TITUS	S300FS	8	---		32"	4"	1/8"	3/4"	45.0°	0.0°	DOUBLE-SHORT	DUCT MOUNT INSTALLATION	REFER TO SPECIFICATIONS.
HDG	EGGCRATE RETURN GRILLE	TITUS	33RL	2	---		30"	30"	---	1"	0.0°		GRID	TYPE 1 (SURFACE)	REFER TO SPECIFICATIONS.

ASHRAE 62.1 VENTILATION RATE PROCEDURE SUMMARY

ROOM IDENTITY NO.	LOCATION NAME	Occupancy Category	Area, Az	Selected Supply Airflow	Number of People, Pz	Outdoor Airflow Rate Per Person, Rp	Outdoor Airflow Rate Per Unit Area, Ra	Zone Air Distribution Effectiveness, Ez	Breathing Zone Outdoor Airflow, Voz	Required Outdoor Air Intake Flow, Vot	OA Delivered	Specified Exhaust Airflow
A116	GYMNASIUM-1	Gym, stadium (play area)	5384 SF	6200 CFM	17	0.0 CFM	0.30 CFM/SF	1	1615 CFM	1615 CFM		0 CFM
A116	GYMNASIUM-2	Multi-use assembly	1424 SF	2100 CFM	145	7.5 CFM	0.06 CFM/SF	1	1173 CFM	1173 CFM		0 CFM
A116	GYMNASIUM-3	Multi-use assembly	1433 SF	2200 CFM	145	7.5 CFM	0.06 CFM/SF	1	1173 CFM	1173 CFM		0 CFM
A142	STAGE	Stages, studios	1378 SF	1500 CFM	0	10.0 CFM	0.06 CFM/SF	1	83 CFM	83 CFM		0 CFM
RTU-H5 GYM: 4			9619 SF	12000 CFM	307				4044 CFM	4044 CFM	0 CFM	0 CFM
D124	GYMNASIUM-1	Gym, stadium (play area)	4737 SF	5000 CFM	16	0.0 CFM	0.30 CFM/SF	0.8	1421 CFM	1776 CFM		0 CFM
D124	GYMNASIUM-2	Multi-use assembly	618 SF	1500 CFM	52	7.5 CFM	0.06 CFM/SF	0.8	427 CFM	534 CFM		0 CFM
RTU-M5 GYM: 2			5355 SF	6500 CFM	68				1848 CFM	2310 CFM	0 CFM	0 CFM

HIGH SCHOOL GYMNASIUM
SHORT-TERM CONDITIONS CALCULATION
PEAK OCCUPIED MINUTES: 300.00
% OCCUPIED (OFF PEAK)

V (CUBIC FT)	Vbz (CFM)	Zone Population (Pz)	Zone Population (Pz) Averaged Over T
123820	1615	30	17
31500	2035	260	145
31500	2036	260	145
21650	83	0	0
TOTALS		550	307
V (CUBIC FT)	Vbz (CFM)		T = 3 * v/Vbz (averaging time period)
208470	5769		108.41

MIDDLE SCHOOL GYMNASIUM
SHORT-TERM CONDITIONS CALCULATION
PEAK OCCUPIED MINUTES: 300.00
% OCCUPIED (OFF PEAK)

V (CUBIC FT)	Vbz (CFM)	Zone Population (Pz)	Zone Population (Pz) Averaged Over T
94750	1615	30	16
11700	2035	100	52
TOTALS		130	68
V (CUBIC FT)	Vbz (CFM)		T = 3 * v/Vbz (averaging time period)
106450	2760		115.71

**OUTSIDE AIRFLOW CALCULATIONS BASED ON ASHRAE STANDARD 62.1-2019 SECTION 6.2.5.2 SHORT TERM CONDITIONS

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT
JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MANSFIELD, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
GMARCHITECTS.COM

RENOVATION OF
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11535 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

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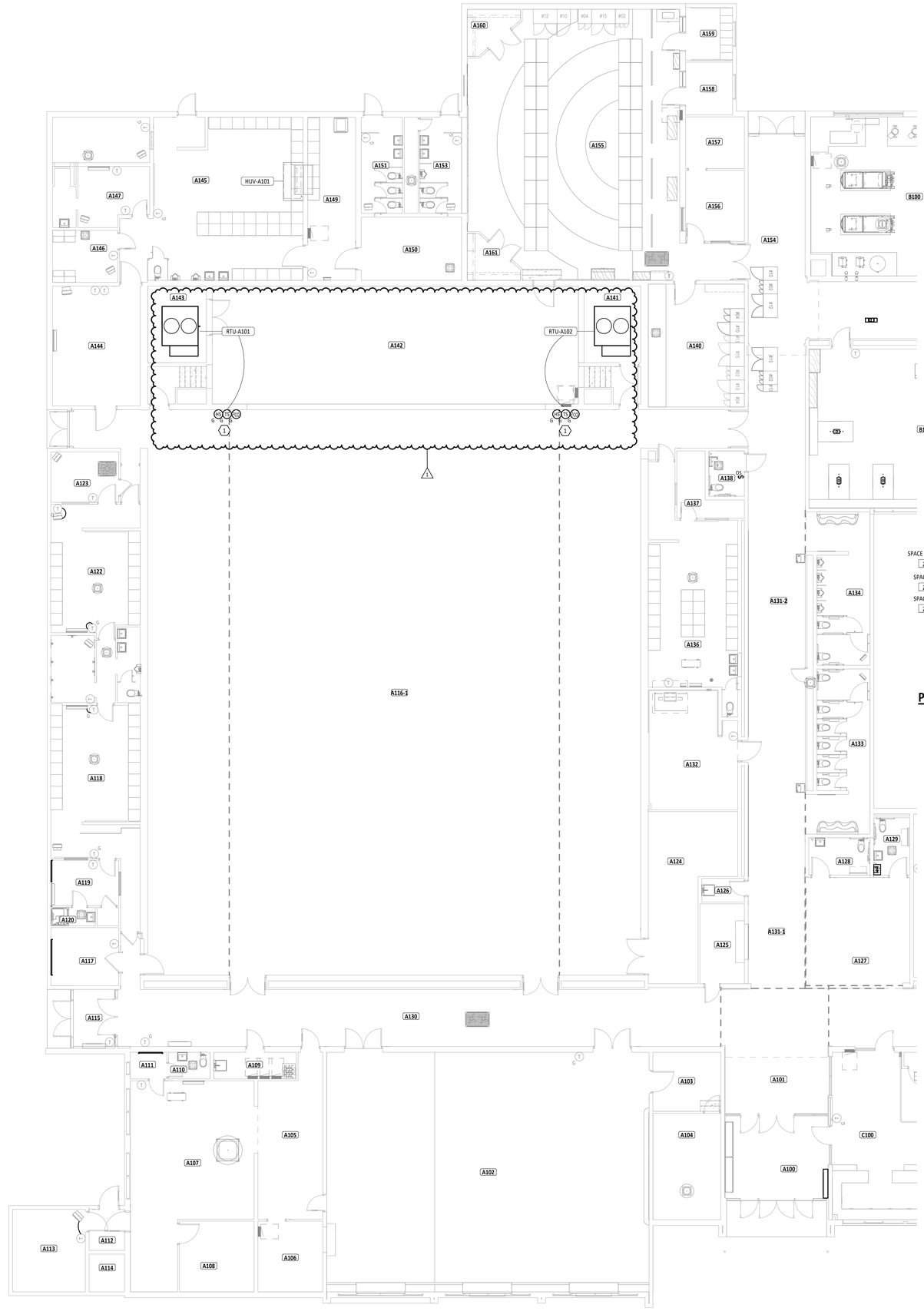
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SHEET TITLE:
MECHANICAL SCHEDULES

SHEET NUMBER:
M5.1

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SPACE CARBON DIOXIDE
ZN-CO2 AI

SPACE HUMIDITY
ZN-H AI

SPACE TEMPERATURE
ZN-T AI

BACNET MS/TP OR IP

REFER TO SEQUENCE OF OPERATION FOR LIST OF REQUIRED INTEGRATION POINTS

PACKAGED OUTDOOR AHU

PACKAGED OUTDOOR AHU SCHEMATIC
RTU-A101 & RTU-A102

POINT LIST

POINT TAG	POINT DESCRIPTION	HARDWARE POINTS				SOFTWARE POINTS				
		DI	AI	DO	AO	DV	AV	ALARM	TREND	GRAPHIC
ZN-T	SPACE TEMPERATURE		X						X	X
ZN-H	SPACE HUMIDITY		X						X	X
ZN-CO2	SPACE CARBON DIOXIDE		X						X	X
UNIT MODE	OCC, UNOCC, WARM UP, COOL DOWN				X				X	X
	OCCUPIED HEATING SETPOINT				X					X
	OCCUPIED COOLING SETPOINT				X					X
	UNOCCUPIED HEATING SETPOINT				X					X
	UNOCCUPIED COOLING SETPOINT				X					X
	DUCT STATIC PRESSURE SETPOINT					X				X
	SUPPLY AIRFLOW SETPOINT (CFM)					X				X
	MINIMUM SUPPLY AIRFLOW SETPOINT (CFM)				X					X

TEMPERATURE CONTROL GENERAL NOTES

A REFER TO SECTION 23 0913 AND 23 0993 FOR TEMPERATURE CONTROL SPECIFICATIONS.

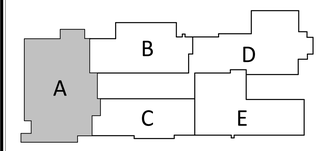
B MOUNT THE THERMOSTATS AND SENSORS WITH BOTTOM AT 44" AFF UNLESS OTHERWISE NOTED, A MINIMUM OF 8" FROM LIGHT SWITCH. COORDINATE HEIGHT WITH LIGHT SWITCHES. SEE DETAIL FOR ADDITIONAL INFORMATION.

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#	KEYNOTE DESCRIPTION
1	SPACE TEMPERATURE AND HUMIDITY SENSOR TO BE LOCATED IN APPROXIMATE LOCATION SHOWN. PROVIDE GUARD PROTECTION PER SPECIFICATIONS. RACEWAY TO BE PAINTED TO MATCH WALL COLOR IN LOCATION. COORDINATE WORK WITH GENERAL CONTRACTOR.

THERMOSTAT / SENSOR LEGEND

- CO2 CARBON DIOXIDE SENSOR
- CO CARBON MONOXIDE SENSOR
- NO2 NITROGEN DIOXIDE SENSOR
- HS HUMIDITY SENSOR
- H HUMIDISTAT
- TH TEMPERATURE & HUMIDITY SENSOR
- TS TEMPERATURE SENSOR
- T THERMOSTAT
- SW MANUAL SWITCH
- S SENSOR
- G GUARD
- E ELECTRIC LINE VOLTAGE THERMOSTAT
- R REVERSE ACTING THERMOSTAT



KEY PLAN

1 M6.1 **TEMPERATURE CONTROL PLAN - UNIT A**
1/8" = 1'-0"

N

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT
JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MARIETTA, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
GMPNET.COM

RENOVATION OF

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11505 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS		
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	ICW	MAK

SHEET TITLE:

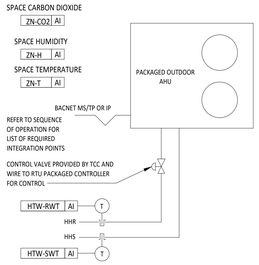
TEMPERATURE CONTROL PLAN - UNIT A

SHEET NUMBER:

M6.1

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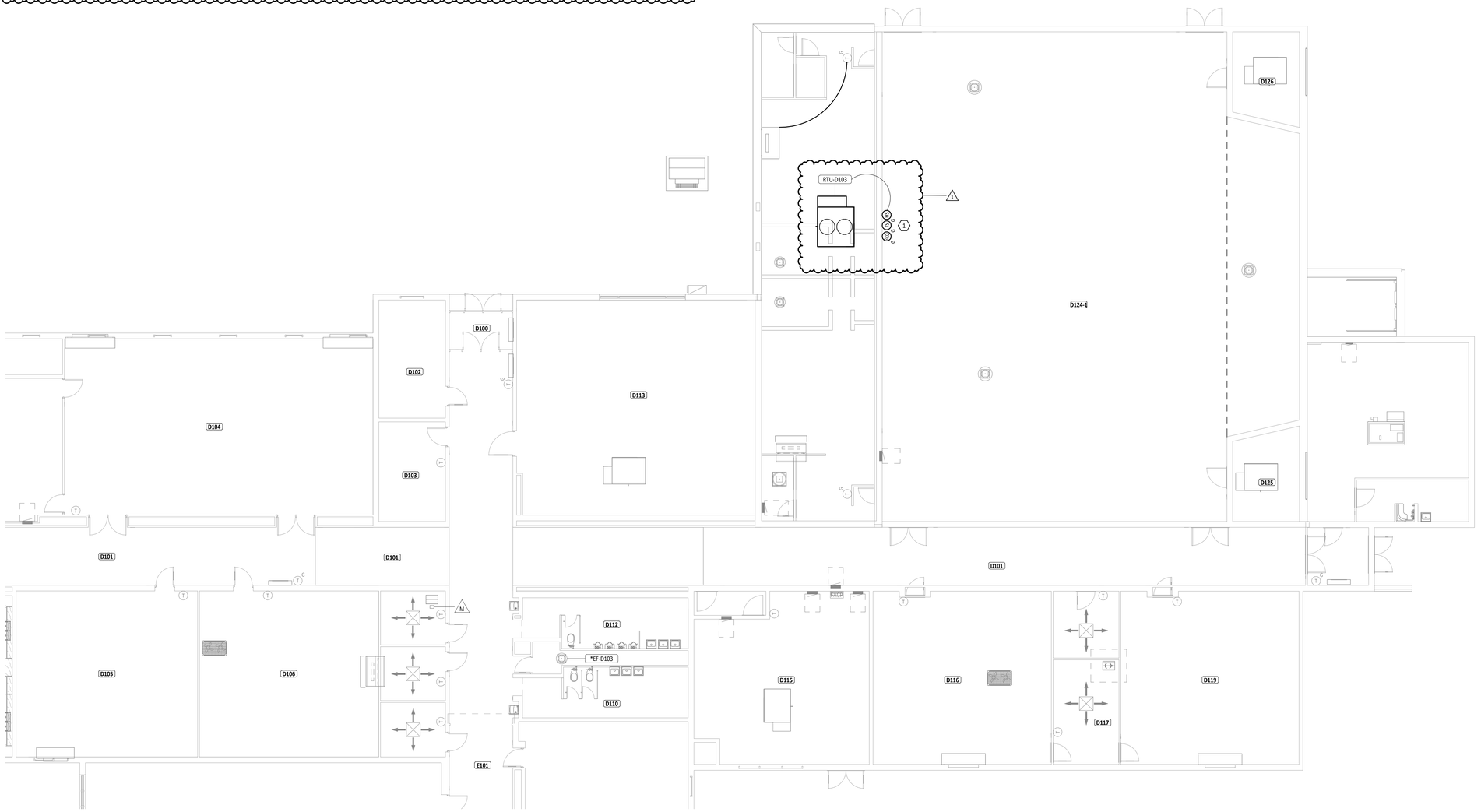


PACKAGED OUTDOOR RTU SCHEMATIC
RTU-D103

POINT LIST

POINT TAG	POINT DESCRIPTION	HARDWARE POINTS				SOFTWARE POINTS			
		DI	AI	DO	AO	DV	AV	ALARM	TREND	GRAPHIC
ZN-T	SPACE TEMPERATURE		X				X		X	X
ZN-H	SPACE HUMIDITY		X				X		X	X
ZN-CO2	SPACE CARBON DIOXIDE		X				X		X	X
UNIT MODE	OCC, UNOCC, WARM UP, COOL DOWN				X				X	
	OUTSIDE AIR TEMPERATURE SENSOR		X				X		X	X
	SUPPLY AIR TEMPERATURE SENSOR		X				X		X	X
	OCCUPIED HEATING SETPOINT				X		X			X
	OCCUPIED COOLING SETPOINT				X		X			X
	UNOCCUPIED HEATING SETPOINT				X		X			X
	UNOCCUPIED COOLING SETPOINT				X		X			X
	DUCT STATIC PRESSURE SETPOINT						X			X
	SUPPLY AIRFLOW SETPOINT (CFM)						X			X
	MINIMUM SUPPLY AIRFLOW SETPOINT (CFM)				X		X			X

** TCC IS RESPONSIBLE TO WIRE AND INSTALL ALL SENSORS FURNISHED WITH THE UNIT. THESE SENSORS INCLUDE BUY ARE NOT LIMITED TO SPACE RELATIVE HUMIDITY SENSOR AND BUILDING PRESSURE SENSOR



1 / M6.2 TEMPERATURE CONTROL PLAN - UNIT D
1/8" = 1'-0"

TEMPERATURE CONTROL GENERAL NOTES

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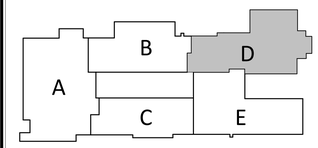
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- SW MANUAL SWITCH
- S SENSOR
- G GUARD
- E ELECTRIC LINE VOLTAGE THERMOSTAT
- R REVERSE ACTING THERMOSTAT



KEY PLAN

STATE OF OHIO
JOHN T. MUSIELEWICZ
12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
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RENOVATION OF
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11535 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS		
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	ICW	MAK

SHEET TITLE:
TEMPERATURE CONTROL PLAN - UNIT D

SHEET NUMBER:
M6.2

PRINTED ON: 10/12/2026 2:13:03 PM

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- NOTE:

	ABBREVIATIONS USED ON THE CONTRACT DOCUMENTS, INCLUDE BUT ARE NOT LIMITED TO THOSE LISTED BELOW.

ABBREVIATIONS

A

A	AMPS, AMPERE, AMPERAGE
A/V	AUDIO/VISUAL
AC	ABOVE COUNTER
ac	ALTERNATING CURRENT
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AVAILABLE INTERRUPTING CURRENT
AL	ALUMINUM
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE

B

BKR	BREAKER
BTM	BOTTOM

C

C	CONDUIT
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CKT	CIRCUIT
CU	COPPER

D

dc	DIRECT CURRENT
DIA	DIAMETER

E

EC	ELECTRICAL CONTRACTOR
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EX	EXISTING

F

FA	FIRE ALARM
FAA	FIRE ALARM ANNUNCIATOR
FACP	FIRE ALARM CONTROL PANEL
FDR	FEEDER
FLA	FULL LOAD AMPS
FUT	FUTURE

G

GEN	GENERATOR
GFI OR GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFP OR GFPE	GROUND FAULT PROTECTION OF EQUIPMENT
GND	GROUND

H

HOA	HAND-OFF-AUTO
HP	HORSEPOWER
HT	HEIGHT

I

IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IG	ISOLATED GROUND

K

KCMIL	THOUSAND CIRCULAR MILS
KV	KILOVOLT
KVA	KILOVOLT AMPS
KVAR	KILOVOLT AMPS REACTIVE
KW	KILOWATT
KWH	KILOWATT HOUR

L

LOC	LOCATION
LSIG	LONG TIME, SHORT TIME, INSTANTANEOUS, AND GROUND FAULT PROTECTION

M

mA	MILLIAMPS
MAX	MAXIMUM
MCA	MINIMUM CIRCUIT AMPACITY
MCC	MOTOR CONTROL CENTER
MH	MOUNTING HEIGHT
MIN	MINIMUM
MTD	MOUNTED
MTS	MANUAL TRANSFER SWITCH

N

N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NEUT	NEUTRAL
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NTS	NOT TO SCALE

O

OH	OVERHEAD

P

P	POLE
PA	PUBLIC ADDRESS
PC	PHOTOCELL
PH	PHASE
PVC	POLYVINYL CHLORIDE

R

RGS	RIGID GALVANIZED STEEL

S

SPD	SURGE PROTECTION DEVICE
SW	SWITCH

T

TEMP	TEMPORARY
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL

U

UG	UNDERGROUND
UL	UNDERWRITERS' LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTABLE POWER SUPPLY

V

V	VOLTS, VOLTAGE
VFD	VARIABLE FREQUENCY DRIVE

W

W	WIRE
WG	WIRE GUARD
WP	WEATHER PROOF

X

XFMR	TRANSFORMER

WIRING DEVICE SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING LOC.	MOUNTING HT.
	SOLID HATCH INDICATES DEVICE CONNECTED TO EMERGENCY POWER. PROVIDE RED DEVICE WITH COVERPLATE TO MATCH REST OF ROOM.	WALL, UNO	VARIES
X	DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE MOUNTED VERTICALLY.	WALL, UNO	16"
X	DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE. EXTRA LINE INDICATES DEVICE TO BE MOUNTED HORIZONTALLY.		
X	DOUBLE DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COMMON COVERPLATE.		
X	SINGLE RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE MOUNTED VERTICALLY.		
X	SPECIAL PURPOSE RECEPTACLE WITH COVERPLATE. REFER TO PLANS FOR TYPE.	WALL, UNO	44", UNO
X	DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE MOUNTED VERTICALLY.		
X	DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE. EXTRA LINE INDICATES DEVICE TO BE MOUNTED HORIZONTALLY.		
X	DOUBLE DUPLEX RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COMMON COVERPLATE.		
X	SINGLE RECEPTACLE, 20A, 125V, NEMA 5-20R, WITH COVERPLATE MOUNTED VERTICALLY.		
X	IN FLOOR SINGLE RECEPTACLE. TYPE AS INDICATED ON PLANS.	FLOOR	VARIES
X	IN FLOOR DUPLEX RECEPTACLE. TYPE AS INDICATED ON PLANS.		
X	IN FLOOR DOUBLE DUPLEX RECEPTACLE. TYPE AS INDICATED ON PLANS.		
X	IN FLOOR SPECIAL PURPOSE RECEPTACLE. TYPE AS INDICATED ON PLANS.		
X	CEILING MOUNTED SINGLE RECEPTACLE.	CEILING	FLUSH
X	CEILING MOUNTED DUPLEX RECEPTACLE.		
X	CEILING MOUNTED DOUBLE DUPLEX RECEPTACLE.		
X	CEILING MOUNTED SPECIAL PURPOSE RECEPTACLE.		
X	PEDESTAL MOUNTED SINGLE RECEPTACLE.	FLOOR	VARIES
X	PEDESTAL MOUNTED DUPLEX RECEPTACLE.		
X	PEDESTAL MOUNTED DOUBLE DUPLEX RECEPTACLE.		
X	PEDESTAL MOUNTED SPECIAL PURPOSE RECEPTACLE.		
	'X' INDICATES RECEPTACLE TYPE OTHER THAN STANDARD NO DESIGNATOR INDICATES STANDARD POWER DEVICE GFI = GFCI RATED GFT = GFCI RATED AND TAMPER RESISTANT TR = TAMPER RESISTANT IG = ISOLATED GROUND U = USB CHARGING PORTS VID = VIDEO OUTLET — 60" VP = VIDEO PROJECTOR — 80" WC = WATER COOLER WF = WASH FOUNTAIN WP = WEATHER-PROOF AND GFCI RATED (METAL IN-USE COVERPLATE) MW = MICROWAVE - COORDINATE WITH CASEWORK INSTALLER. — 60"		
X	FLOOR BOX WITH TWO (2) DUPLEX RECEPTACLES, NEMA 5-20R, UNO. 'X' INDICATES TYPE, REFER TO SPECIFICATIONS. PROVIDE PROPER COVER FOR THE ASSOCIATED FLOOR TYPE (CARPET, TILE, WOOD, ETC.) COORDINATE WITH FLOOR INSTALLER.	FLOOR	VARIES
X	POKE-THRU WITH TWO (2) DUPLEX RECEPTACLES, NEMA 5-20R, UNO. 'X' INDICATES TYPE, REFER TO SPECIFICATIONS. PROVIDE PROPER COVER FOR THE ASSOCIATED FLOOR TYPE (CARPET, TILE, WOOD, ETC.) COORDINATE WITH FLOOR INSTALLER.		
	JUNCTION BOX OR EQUIPMENT CONNECTION.	VARIES, SEE PLANS	VARIES, SEE PLANS
	JUNCTION BOX OR EQUIPMENT CONNECTION WITH SWITCH FOR MAINTENANCE DISCONNECT. PROVIDE SWITCH RATED FOR VOLTAGE AND LOAD SHOWN ON PLANS.		
	WALL MOUNTED JUNCTION BOX.		
	MOTOR CONNECTION.	N/A	N/A
	MOTOR CONNECTION WITH SWITCH FOR MAINTENANCE DISCONNECT. PROVIDE SWITCH RATED FOR VOLTAGE AND LOAD SHOWN ON PLANS.		
DT	0-6 HOUR DIGITAL TIMER RATED FOR LOAD BEING CONTROLLED.	WALL	44", UNO
F	20A, FUSED MOTOR SWITCH, PROVIDE OVERLOADS RATED TO MOTOR.		
	CORD REEL RECEPTACLE. REFER TO SPECIFICATIONS FOR TYPE.	STRUCTURE	VARIES
	DROP CORD RECEPTACLE. REFER TO ASSOCIATED DROP CORD DETAIL FOR MORE INFORMATION.		

NOTE: ALL SYMBOLS OR ABBREVIATIONS MAY NOT BE USED FOR THIS PROJECT AND ARE SUBJECT TO CHANGE ON OTHER DRAWINGS.

LAST UPDATED: 01/26/2022

ELECTRICAL EQUIPMENT SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING LOC.	MOUNTING HT.
	SURFACE MOUNTED PANELBOARD - CIRCUIT BREAKER TYPE. DASHED LINES ON PLAN INDICATE CLEARANCES. REFER TO PANEL SCHEDULES AND ONE-LINE DIAGRAM.	VARIES	78" TO TOP
	FLUSH MOUNTED PANELBOARD - CIRCUIT BREAKER TYPE. DASHED LINES ON PLAN INDICATE CLEARANCES. REFER TO PANEL SCHEDULES AND ONE-LINE DIAGRAM.		
	DISTRIBUTION PANEL - CIRCUIT BREAKER TYPE. DASHED LINES ON PLAN INDICATE CLEARANCES. REFER TO PANEL SCHEDULES AND ONE-LINE DIAGRAM.	VARIES	VARIES
	METER BASE.	VARIES	78" TO TOP
	NON-FUSED DISCONNECT SWITCH.		
	FUSED DISCONNECT SWITCH.		
	COMBINATION MAGNETIC MOTOR STARTER AND DISCONNECT SWITCH.		
	MAGNETIC MOTOR STARTER.		
CP	CONTROL PANEL. REFER TO PLANS FOR MORE INFORMATION.	VARIES	72" TO TOP UNO
PB	PULL BOX. REFER TO PLANS FOR MORE INFORMATION. 1		
MTS	MANUAL TRANSFER SWITCH.		
ECB	ENCLOSED CIRCUIT BREAKER.		
VFD	VARIABLE FREQUENCY DRIVE.		
	GROUND BAR. REFER TO GROUNDING DETAIL.	WALL	16"

DEMOLITION

SYMBOL	DESCRIPTION	NOTES
	DASHED SYMBOL INDICATES EXISTING DEVICE OR EQUIPMENT TO BE REMOVED.	REFER TO DEMOLITION PLANS FOR ADDITIONAL INFORMATION
	SOLID SYMBOL, LIGHTER IN COLOR INDICATES EXISTING DEVICE OR EQUIPMENT TO REMAIN.	

RACEWAY & CONDUCTORS

SYMBOL	DESCRIPTION
	TICK MARKS DENOTING CONDUCTOR IDENTIFICATION. REFER TO 'KEY TO ELECTRICAL CIRCUIT WIRING' DETAIL FOR MORE INFORMATION.
	CIRCUIT CONCEALED IN CEILING, WALL, OR FLOOR OF NEW CONSTRUCTION. CONCEALED WHEREVER POSSIBLE IN AREAS OF OPEN STRUCTURE OR EXISTING CONSTRUCTION.
	INDICATES CONCEALED CONDUIT UNDERGROUND/UNDERFLOOR
	HOMERUN TO PANEL OR LOCATION NOTED
	SURFACE MOUNT RACEWAY. REFER TO PLANS FOR TYPE. DENOTES HORIZONTALLY MOUNTED RACEWAY DENOTES VERTICALLY MOUNTED RACEWAY
(2)2"	CONDUIT SLEEVE(S) ABOVE CEILING FOR TECHNOLOGY CABLING. (#) INDICATES QUANTITY, #" INDICATES CONDUIT SIZE. REFER TO ARCHITECTURAL SECTIONS FOR CEILING HEIGHTS.
	LADDER TYPE CABLE TRAY. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
	WIRE MESH CABLE TRAY. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
DOWN UP	CONDUIT TURNS

GENERAL DRAWINGS SYMBOLS

X	KEYED NOTE REFERENCE
X	REVISION NUMBER - SHOWN ON PLANS
	CONTINUATION SYMBOL
	NUMBER OF DETAIL ON SHEET DRAWING NUMBER WHERE DETAIL APPEARS

FIRE ALARM SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING LOC.	MOUNTING HT.
FACP	FIRE ALARM CONTROL PANEL. REFER TO SPECIFICATIONS.	WALL	72" TO TOP
NAC	FIRE ALARM NAC POWER SUPPLY. REFER TO SPECIFICATIONS.		
FAA	FIRE ALARM ANNUNCIATOR PANEL. REFER TO SPECIFICATIONS.	WALL	48"
F	FIRE ALARM PULL STATION. REFER TO SPECIFICATIONS.	WALL	44"
	FIRE ALARM HORN DEVICE. REFER TO SPECIFICATIONS.	WALL	80", UNO
	FIRE ALARM HORN/STROBE DEVICE. REFER TO SPECIFICATIONS.		
	FIRE ALARM SPEAKER DEVICE. REFER TO SPECIFICATIONS.		
	FIRE ALARM SPEAKER/STROBE DEVICE. REFER TO SPECIFICATIONS.		
	FIRE ALARM STROBE LIGHT ONLY DEVICE. REFER TO SPECIFICATIONS.		
	FIRE ALARM SPEAKER DEVICE. REFER TO SPECIFICATIONS.	CEILING	SURFACE
	FIRE ALARM SPEAKER/STROBE DEVICE. REFER TO SPECIFICATIONS.		
	FIRE ALARM SMOKE DETECTOR. REFER TO SPECIFICATIONS.		
	FIRE ALARM HEAT DETECTOR. REFER TO SPECIFICATIONS.		
CO	CARBON MONOXIDE DETECTOR. REFER TO SPECIFICATIONS.		
	FIRE ALARM DUCT SMOKE DETECTOR. REFER TO SPECIFICATIONS.	DUCT MTD.	SEE PLANS
	FIRE ALARM MAGNETIC DOOR HOLDER. REFER TO SPECIFICATIONS.	WALL	VARIES
	FIRE ALARM REMOTE TEST STATION FOR HIDDEN SMOKE/DUCT DETECTOR. REFER TO SPECIFICATIONS.	VARIES	SEE PLANS
AM	FIRE ALARM ADDRESSABLE MODULE (MONITOR OR RELAY). REFER TO SPECIFICATIONS.		
SD	SMOKE DAMPER CONNECTION. REFER TO PLANS FOR TYPE.	AT DUCT	SEE PLANS

PANEL H1

MOUNTING: SURFACE
FED FROM: MSB
ENCLOSURE: NEMA 1
LOCATION: TOOL STORAGE B103
AIC RATING: 18,000
VOLTAGE: 480Y/277V 3PH 4W
MAINS RATING: 400 A
MAINS TYPE: MLO
OTHER:
(EXISTING) (HIGH SCHOOL)
PANEL NOTES:
EXISTING TO REMAIN PANELBOARD IS A SQUARE D NF TYPE

NOTE	CIRCUIT DESCRIPTION	POLES	AMP	CKT	A	B	C	CKT	AMP	POLES	CIRCUIT DESCRIPTION	NOTE
				1	6629 / 2749			2				
E	VRF ART RM EQUIPMENT	3	30	3		6629 / 2749		4	15	3	VRF B103 ROOF EQUIPMENT	E
				5			6629 / 2749	6				
				7	2749 / 3636			8				
E	VRF C104 ROOF EQUIPMENT	3	15	9		2749 / 3636		10	20	3	VRF B101 ROOF EQUIPMENT	E
				11			2749 / 3636	12				
				13	4722 / 4722			14				
E	VRF-C101 ROOF EQUIPMENT	3	25	15		4722 / 4722		16	25	3	VRF B102 ROOF EQUIPMENT	E
				17			4722 / 4722	18				
				19	3680 / 4722			20				
E	VRF-C103 ROOF EQUIPMENT	3	20	21		3680 / 4722		22	25	3	VRF A101 CAFETERIA	E
				23			3680 / 4722	24				
				25	3636 / 13302			26				
E	VRF-A103 BAND ROOM EQUIPMENT	3	20	27		3636 / 13302		28	60	3	RTU-A102 OVER HS GYM (SOUTH)	B,1
				29			3636 / 13302	30				
				31	0 / 13300			32				
E	SPARE BREAKER	3	45	33		0 / 13300		34	60	3	RTU-A101 OVER HS GYM (NORTH)	B,1
				35			0 / 13300	36				
				37	0 / 0			38				
	SPARE BREAKER	3	30	39		0 / 0		40	30	3	SPARE BREAKER	
				41			0 / 0	42				
	VA SUBTOTALS:				63848 VA	63848 VA	63848 VA					
	AMP SUBTOTALS:				230 A	230 A	230 A					

LOAD TYPE:	CONNECTED VA	DEMAND FACTOR	DEMAND VA	DEMAND AMPS	SUBTOTAL	PHASE
MOTORS	100830 VA	104.9%	105802 VA	127 A	63848 VA	A
MISC EQUIPMENT	0 VA	0.0%	0 VA	0 A	63848 VA	B
HVAC	90714 VA	100.0%	90714 VA	109 A	63848 VA	C
					PANEL TOTALS	
					191544 VA	CONNECTED
					196516 VA	DEMAND
					230 A	CONNECTED
					236 A	DEMAND

CIRCUIT NOTES:
E = EXISTING LOAD ON EXISTING BREAKER
N = NEW LOAD ON EXISTING BREAKER
B = PROVIDE NEW BREAKER SHOWN, TYPE TO MATCH EXISTING.
1 = 3-#6 AWG CU,1-#8 AWG CU GND, 1"C

PANEL H2

MOUNTING: SURFACE
FED FROM: MSB
ENCLOSURE: NEMA 1
LOCATION:
AIC RATING: 10,000
VOLTAGE: 480Y/277V 3PH 4W
MAINS RATING: 400 A
MAINS TYPE: MLO
OTHER:
(EXISTING) (MIDDLE SCHOOL)
PANEL NOTES:
EXISTING TO REMAIN PANELBOARD IS A SQUARE D NF TYPE

NOTE	CIRCUIT DESCRIPTION	POLES	AMP	CKT	A	B	C	CKT	AMP	POLES	CIRCUIT DESCRIPTION	NOTE
				1	2749 / 2749			2				
E	VRF E103	3	15	3		2749 / 2749		4	15	3	VRF E101	E
				5			2749 / 2749	6				
				7	4722 / 2749			8				
E	VRF E104	3	25	9		4722 / 2749		10	15	3	VRF D101 ROOF EQUIPMENT	E
				11			4722 / 2749	12				
				13	2749 / 2749			14				
E	VRF E105	3	15	15		2749 / 2749		16	15	3	VRF E102 ROOF EQUIPMENT	E
				17			2749 / 2749	18				
				19	2749 / 11917			20				
B,1	RTU D103	3	70	21		2749 / 11917		22	70	3	RTU-D103 GYM UNIT ON LOCKER ROOF	E
				23			2749 / 11917	24				
				25	3935 / 3381			26				
E	RTU D101 MULTI-PURPOSE	3	25	27		3935 / 3381		28	20	3	RTU D102 ROOF EQUIPMENT	E
				29			3935 / 3381	30				
				31	6319 / 4940			32				
E	RTU MEDIA CENTER E101	3	40	33		6319 / 6720		34	50	3	XFMR LIFE SKILLS T-LS	E
				35			6319 / 6000	36				
				37	3048 / 0			38				
E	LIFE SKILLS EXISTING RTU	3	15	39		3048 / 0		40	30	3	SPARE BREAKER	
				41			3048 / 0	42				
	VA SUBTOTALS:				54757 VA	56537 VA	55817 VA					
	AMP SUBTOTALS:				198 A	205 A	202 A					

LOAD TYPE:	CONNECTED VA	DEMAND FACTOR	DEMAND VA	DEMAND AMPS	SUBTOTAL	PHASE
EXISTING	8160 VA	100.0%	8160 VA	10 A	54757 VA	A
Electric Clothes Dryer	4500 VA	100.0%	4500 VA	5 A	56537 VA	B
Electric Range - Less...	5000 VA	80.0%	4000 VA	5 A	55817 VA	C
MOTORS	8247 VA	125.0%	10309 VA	12 A	PANEL TOTALS	
MISC EQUIPMENT	0 VA	0.0%	0 VA	0 A	167110 VA	CONNECTED
HVAC	132057 VA	100.0%	132057 VA	159 A	168171 VA	DEMAND
exist HVAC EQUIPMENT	9145 VA	100.0%	9145 VA	11 A	201 A	CONNECTED
					202 A	DEMAND

CIRCUIT NOTES:
E = EXISTING LOAD ON EXISTING BREAKER
B = PROVIDE NEW BREAKER SHOWN, TYPE TO MATCH EXISTING.
1 = 3-#4 AWG CU,1-#8 AWG CU GND, 1-1/4"C

PANEL R

MOUNTING: SURFACE
FED FROM: HSMDB
ENCLOSURE: NEMA 1
LOCATION: BOILER ROOM B100
AIC RATING: 13,543 ISC
VOLTAGE: 208Y/120V 3PH 4W
MAINS RATING: 225 A
MAINS TYPE: MLO
OTHER:
(NEW PANELBOARD) (HIGH SCHOOL)
PANEL NOTES:
PANEL IS POWERED THROUGH 'HSMDB'

NOTE	CIRCUIT DESCRIPTION	POLES	AMP	CKT	A	B	C	CKT	AMP	POLES	CIRCUIT DESCRIPTION	NOTE
E	EUH-A102 BOY'S RESTROOM A134	1	20	1	1500 / 1500			2	20	1	EUH-A101 GIRL'S RESTROOM A133	E
E	LOCKER RM UNIT HEATERS	1	20	3		252 / 651		4	20	1	LIGHTING ROOM A133, A134, A131	E
E	LIGHTING ROOM A131, A154	1	20	5			55 / 17	6	20	1	GYMNASIUM EXIT LIGHTS	E
E	HAND DRYER RESTRM A138	1	20	7	1440 / 13			8	20	1	EXIT SIGNS, HIGH SCHOOL	E
E	HAND DRYER BOY'S RESTRM A134	1	20	9		1440 / 1440		10	20	1	HAND DRYER BOY'S RESTRM A134	E
E	HAND DRYER GIRL'S RESTRM A133	1	20	11			1440 / 1440	12	20	1	HAND DRYER GIRL'S RESTRM A133	E
E	HAND DRYER FAMILY RESTRM A128	1	20	13	1440 / 1440			14	20	1	HAND DRYER FAMILY RESTRM A129	E
E	HAND DRYER RESTROOM B122	1	20	15		1440 / 1206		16	20	2	SSCU-A102a MINI-SPLIT	E
E	EF-A113 BAND STORAGE	1	20	17			696 / 1206	18				
E	EF-A102 LOCKER ROOM	1	20	19	696 / 1647			20	20	2	VRF A102 LOCKERS	E
E	HVAC MUSIC ROOM A155	2	20	21		416 / 1647		22				
				23			416 / 360	24	20	1	RTU-A102/103 RECEPTACLE	1
	SPARE BREAKER	1	20	25	0 / 0			26	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	27		0 / 0		28	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	29			0 / 0	30	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	31	0 / 0			32	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	33		0 / 0		34	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	35			0 / 0	36	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	37	0 / 0			38	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	39		0 / 0		40	20	1	SPARE BREAKER	
	SPACE ONLY	1	--	41			0 / 0	42	--	1	SPACE ONLY	
	VA SUBTOTALS:				9763 VA	8427 VA	5589 VA					
	AMP SUBTOTALS:				85 A	74 A	47 A					

LOAD TYPE:	CONNECTED VA	DEMAND FACTOR	DEMAND VA	DEMAND AMPS	SUBTOTAL	PHASE
HEAT	3000 VA	100.0%	3000 VA	8 A	9763 VA	A
LIGHTING	828 VA	125.0%	1034 VA	3 A	8427 VA	B
MOTORS	7352 VA	111.2%	8175 VA	23 A	5589 VA	C
Power	11520 VA	70.0%	8064 VA	22 A	PANEL TOTALS	
RECEPTACLE	360 VA	100.0%	360 VA	1 A	23775 VA	CONNECTED
MISC EQUIPMENT	0 VA	0.0%	0 VA	0 A	21342 VA	DEMAND
HVAC	832 VA	100.0%	832 VA	2 A	66 A	CONNECTED
					59 A	DEMAND

CIRCUIT NOTES:
E = EXISTING PHASE 1 LOAD TO REMAIN
1 = 2#10 AWG CU, 1#10 AWG CU GND, 3.4"C

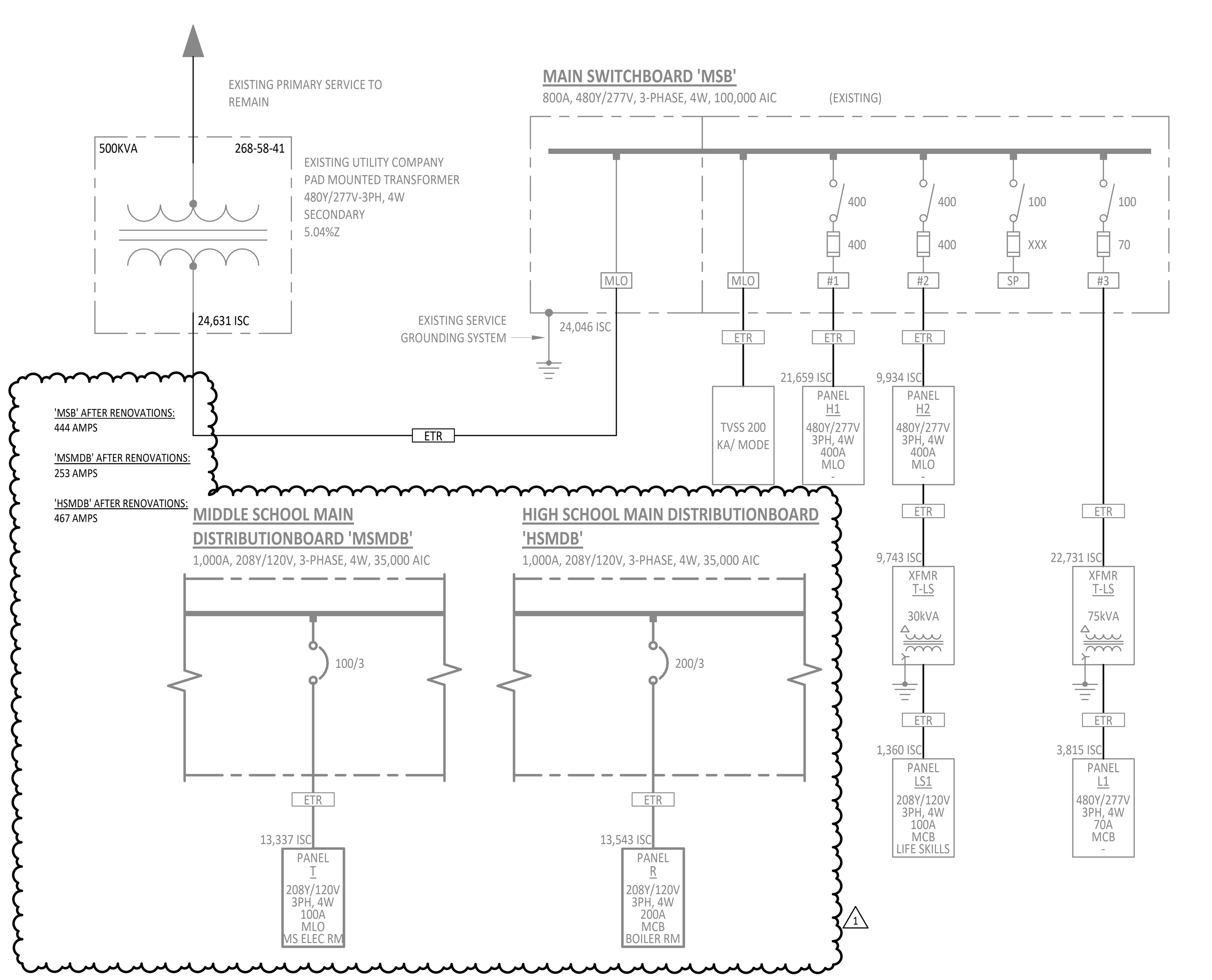
PANEL T

MOUNTING: SURFACE
FED FROM: MSMDB
ENCLOSURE: NEMA 1
LOCATION:
AIC RATING: 13,337
VOLTAGE: 208Y/120V 3PH 4W
MAINS RATING: 100 A
MAINS TYPE: MLO
OTHER:
(NEW PANELBOARD) (MIDDLE SCHOOL)
PANEL NOTES:
PANEL IS FED FROM 'MSMDB'

NOTE	CIRCUIT DESCRIPTION	POLES	AMP	CKT	A	B	C	CKT	AMP	POLES	CIRCUIT DESCRIPTION	NOTE
E	INDOOR VRF CASSETTES	2	15	1	374 / 1724			2	20	2	MINI-SPLIT SSCU-E101a	E
				3		374 / 1724		4				
E	POWER RESTROOM E130	1	20	5			1440 / 1210	6	20	1	MOTORS	E
1	RTU D103 RECEPTACLE	1	20	7	180 / 1440			8	20	1	POWER RESTROOM E131	E
E	SSCU-C101a KILN MINI-SPLIT	2	20	9		1373 / 0		10	20	1	SPARE BREAKER	
				11			1373 / 0	12	20	1	SPARE BREAKER	
				13	4592 / 0			14	20	1	SPARE BREAKER	
E	VRF D102 ROOF EQUIPMENT	3	50	15		4592 / 0		16	20	1	SPARE BREAKER	
				17			4592 / 0	18	20	1	SPARE BREAKER	
				19	1902 / 0			20	20	1	SPARE BREAKER	
E	VRF D104 ROOF EQUIPMENT	3	20	21		1902 / 0		22	25	2	MINI-SPLIT	E
				23			1902 / 0	24				
	SPARE BREAKER	1	20	25	0 / 0			26	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	27		0 / 0		28	20	1	SPARE BREAKER	
	SPARE BREAKER	1	20	29			0 / 0	30	20	1	SPARE BREAKER	
	VA SUBTOTALS:				10213 VA	9966 VA	10517 VA					
	AMP SUBTOTALS:				85 A	83 A	88 A					

LOAD TYPE:	CONNECTED VA	DEMAND FACTOR	DEMAND VA	DEMAND AMPS	SUBTOTAL	PHASE
MOTORS	8153 VA	110.6%	9015 VA	25 A	10213 VA	A
Power	2880 VA	70.0%	2016 VA	6 A	9966 VA	B
RECEPTACLE	180 VA	100.0%	180 VA	0 A	10517 VA	C
MISC EQUIPMENT	0 VA	0.0%	0 VA	0 A	PANEL TOTALS	
HVAC	19483 VA	100.0%	19483 VA	54 A	30696 VA	CONNECTED
					30694 VA	DEMAND
					85 A	CONNECTED
					85 A	DEMAND

CIRCUIT NOTES:
E = EXISTING PHASE 1 LOAD TO REMAIN
1 = 2#10 AWG CU, 1#10 AWG CU GND, 3.4"C



1 / E1.1 **PARTIAL ELECTRICAL ONE-LINE DIAGRAM**
NTS

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ELECTRICAL SHEET INDEX

SHEET NUMBER	SHEET NAME
E1.1	GENERAL NOTES, ABBREVIATIONS, LEGENDS AND SHEET INDEX
ED1.1	ELECTRICAL ROOF DEMOLITION PLAN - OVERALL
E2.1	ELECTRICAL ROOF PLAN - OVERALL

ELECTRICAL GENERAL NOTES

A. ALL GENERAL WALL MOUNT WIRING DEVICES TO BE LIGHT ALMOND IN COLOR. COVERPLATES TO BE STAINLESS STEEL TYPE, MATCHING EXISTING DEVICES. CEILING MOUNT RECEPTACLES TO BE WHITE IN COLOR WITH WHITE, NYLON, UNBREAKABLE COVERS.
B. ALL MOUNTING HEIGHTS REFER TO THE BOTTOM OF BOX OR DEVICE UNO.
C. ALL CONDUIT TO BE CONCEALED WHERE FEASIBLE. EXCEPTION IS TAKEN TO EXISTING CMU WALLS WHERE CONCEALMENT MAY BE DIFFICULT.
D. ALL WORK SHALL CONFORM TO THE 2023 N.E.C., NATIONAL, STATE, AND LOCAL CODES WHICH APPLY.
E. ALL MATERIAL AND EQUIPMENT SHALL CONFORM TO U.L. AND NEMA STANDARDS WHICH APPLY.
F. THIS CONTRACTOR SHALL PAY ALL FEES AND OBTAIN ALL PERMITS REQUIRED TO THE EXECUTION OF HIS WORK.
G. THIS CONTRACTOR SHALL GUARANTEE HIS ENTIRE ELECTRICAL INSTALLATION AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE (1) YEAR.
H. WIRE SIZES BASED ON AWG (AMERICAN WIRE GAUGE) OR KCMIL, MINIMUM WIRE SIZE SHALL BE 12 AWG, UNO.
I. CONDUCTORS SHALL BE TYPE 'THHN/THWN' STRANDED COPPER. CONDUCTORS 6 AWG, AND LARGER, MAY BE COPPER OR ALUMINUM.
J. EXPOSED EXTERIOR CONDUIT SHALL BE RIGID GALVANIZED STEEL OR INTERMEDIATE GRADE METAL CONDUIT. INTERIOR CONDUIT MAY BE ELECTRICAL METALIC TUBING. CONDUIT BURIED BELOW GRADE SHALL BE SCHEDULE 40 PVC WITH APPROPRIATE SIZE GREEN GROUND WIRE UNO.
K. EXISTING SOLID CONDUIT PATHWAYS MAY BE REUSED WHERE CODE COMPLIANT, WHEN USING EXISTING PATHWAYS VERIFY ALL CONNECTIONS ARE TIGHT AND REPLACE ANY QUESTIONABLE STRAPPING.
L. CIRCUITS THAT RUN ACROSS ROOF DECKING IN DIRECT SUNLIGHT SHALL HAVE CONDUCTORS THAT ARE SUNLIGHT RESISTANT PER NEC ARTICLE 310.10(D)

ELECTRICAL DEMOLITION GENERAL NOTES

A. FIELD VERIFY ALL DIMENSIONS & CONDITIONS PRIOR TO START OF CONSTRUCTION. NOTIFY ARCHITECT IMMEDIATELY OF ANY DISCREPANCY OR SITUATION DISCOVERED THAT DOES NOT CONFORM TO CONSTRUCTION DOCUMENTS.
B. ALL WORK PERFORMED IS SUBJECT TO APPROVAL BY THE ARCHITECT AND OWNER. WORK FOUND TO BE UNSATISFACTORY SHALL BE REMOVED AND PROPERLY REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
C. ALL ITEMS AND MATERIAL NOTED AS "REMOVE" SHALL BE PROPERLY DISPOSED OF BY THE CONTRACTOR OFF SITE. COORDINATE REMOVAL OF ITEMS WITH OWNER. OWNER HAS THE OPTION TO CLAIM ANY REMOVED ITEMS.
D. TEMPORARILY SUPPORT ALL EQUIPMENT, CONDUIT, ETC. AS REQUIRED UNTIL FINAL SUPPORTS ARE IN PLACE.
E. CLOSELY COORDINATE ALL WORK WITH THE OWNER AND WITH ALL OTHER CONTRACTORS HIRED BY THE OWNER. CLARIFY IN ADVANCE ANY QUESTIONS AS TO SCOPE OF WORK AND AREAS OF RESPONSIBILITY.
F. CONDUITS, BOXES, AND CIRCUIT BREAKERS MAY BE REUSED WHERE POSSIBLE, IF NOT, MODIFY AS NEEDED FOR NEW WORK.
G. DIV. 26 SHALL REFER TO ARCHITECTURAL, MECHANICAL, AND PLUMBING DEMOLITION PLANS FOR ELECTRICAL DISCONNECTION OR REMOVAL OF ANY ELECTRICAL EQUIPMENT.
H. DIV. 26 SHALL PULL ALL WIRE AND CAP CONDUIT TO ALL CIRCUITS DISCONNECTED AND NOT REUSED.
I. ALL ABANDONED WIRING ABOVE CEILING SHALL BE REMOVED PER THE REQUIREMENTS OF THE NEC.
J. ALL DATA AND VOICE CABLING ASSOCIATED WITH REMOVED EXISTING DEVICES SHALL BE REMOVED, UNLESS OTHERWISE NOTED.

STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT
JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

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creategm.com

RENOVATION FOR

FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT

11158 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	JDB	HJP

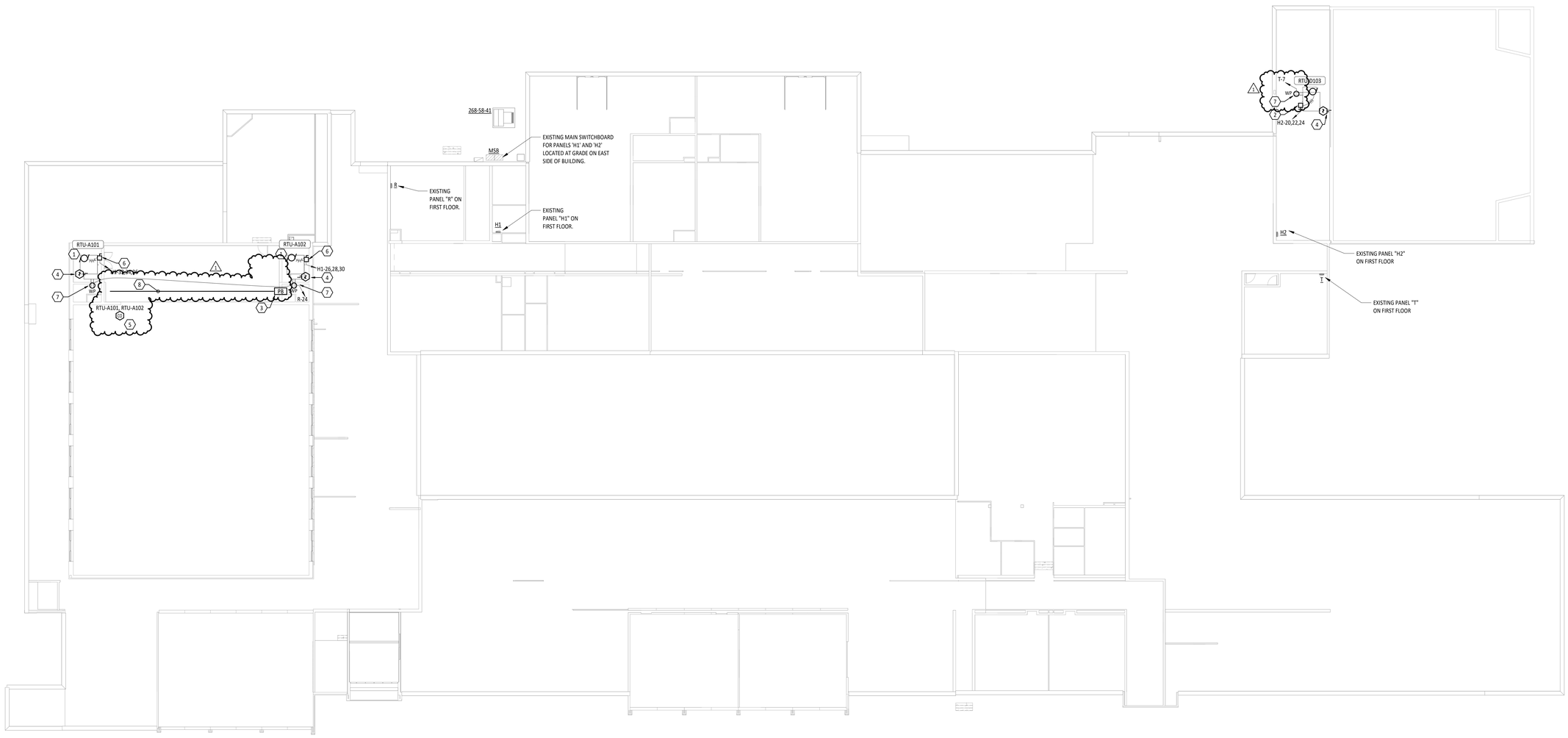
SHEET TITLE:

GENERAL NOTES, ABBREVIATIONS, LEGENDS AND SHEET INDEX

SHEET NUMBER:

E1.1

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1 E2.1 **OVERALL ELECTRICAL ROOF PLAN**
1/16" = 1'-0"

POWER GENERAL NOTES

A WHERE CIRCUITS RUN ACROSS THE ROOF DECK, EXPOSED TO DIRECT SUNLIGHT, THE CONDUCTORS SHALL HAVE SUNLIGHT RESISTANT INSULATION PER NEC ARTICLE 310.10(D).

B WHERE NEW PENETRATIONS ARE TO OCCUR IN ROOFING SYSTEM, UTILIZE A LICENSED ROOFING CONTRACTOR TO MAINTAIN ANY WARRANTIES.

C ALL CONDUCTORS FOR EQUIPMENT CONNECTIONS SHALL BE COPPER UNLESS NOTED OTHERWISE AND APPROVED BY THE MANUFACTURER.

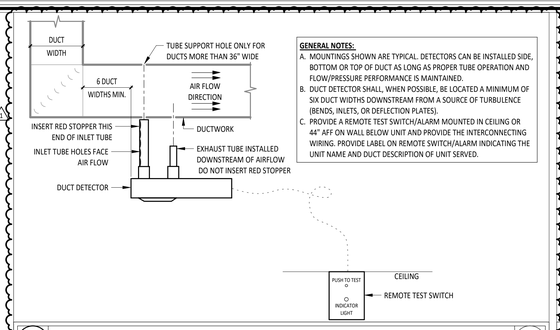
D COORDINATE WITH ALL OTHER TRADES TO MAINTAIN ALL REQUIRED CLEARANCES ABOUT ELECTRICAL EQUIPMENT WITH ACCORDANCE TO THE NATIONAL ELECTRICAL CODE.

E REFER TO MECHANICAL, PLUMBING, AND OTHER APPLICABLE DRAWINGS FOR EXACT EQUIPMENT LOCATIONS.

F MAINTAIN ALL FIRE RATINGS WHERE CONDUIT PENETRATES WALL, CEILINGS, AND FLOORS WITH ONLY U.L. LISTED FIRE ASSEMBLIES.

G ALL MOUNTING HEIGHTS REFER TO BOTTOM OF BOX, UNO.

#	KEYNOTE DESCRIPTION
1	PROVIDE ALL NECESSARY WIRING AND CONNECTIONS TO ROOFTOP UNIT. UTILIZE EXISTING BUILDING PENETRATION FOR PATHWAY, PATCH AND SEAL AROUND PENETRATION. PROVIDE CONDUIT SUPPORT ON ROOF FROM PENETRATION TO UNIT WITH UNISTRUT CHANNEL STAND-OFF ROOF SUPPORTS SUCH AS DURA-BLOCK "DB" SERIES OR EQUAL. SEE NOTE IN PANEL SCHEDULE ON SHEET E1.1 FOR CONDUIT AND CONDUCTOR SIZE.
2	PROVIDE ALL NECESSARY WIRING AND CONNECTIONS TO ROOFTOP UNIT. UTILIZE EXISTING BUILDING PENETRATIONS FOR PATHWAY, PATCH AND SEAL AROUND PENETRATION. PROVIDE CONDUIT SUPPORT FROM PENETRATION TO UNIT WITH UNISTRUT CHANNEL. SEE NOTE IN PANEL SCHEDULE ON SHEET E1.1 FOR CONDUIT AND CONDUCTOR SIZE.
3	REPLACE EXISTING ROOF PENETRATION BOX WITH NEW OF SUITABLE TYPE AND SIZE. UTILIZE SINGLE LOCATION FOR ROOF PENETRATIONS FOR EQUIPMENT IN THIS AREA. COORDINATE WITH ROOFING CONTRACTOR TO PATCH AND SEAL AROUND PENETRATION SPACE.
4	PROVIDE DUCT DETECTOR IN RETURN DUCT OF HVAC SYSTEM. PROVIDE WIRING BACK TO FIRE ALARM SYSTEM FOR MONITORING AND UNIT SHUTDOWN.
5	PROVIDE CARBON MONOXIDE DETECTOR INSIDE THE BUILDING IN THE NEAREST ROOM TO RTU SUPPLY. PROVIDE WIRING TO FIRE ALARM SYSTEM FOR MONITORING AND SHUT DOWN OF HVAC UNITS.
6	PROVIDE 60A, 480V RATED, 3 POLE, NON-FUSED DISCONNECT SWITCH IN A NEMA 3R ENCLOSURE AS LOCAL DISCONNECTING MEANS FOR ROOFTOP MECHANICAL UNIT. COORDINATE WITH MECHANICAL FOR INSTALLATION LOCATION AND NAMEPLATE RATINGS OF UNIT.
7	PROVIDE WEATHERPROOF GFCI DUPLEX RECEPTACLE WITHIN 25' OF MECHANICAL EQUIPMENT. COORDINATE WITH OWNER FOR LOCATION PRIOR TO ROUGH-IN.
8	PROVIDE CONDUIT SUPPORT ON ROOF FROM PENETRATION TO UNIT WITH UNISTRUT CHANNEL STAND-OFF ROOF SUPPORTS SUCH AS DURA-BLOCK "DB" SERIES OR EQUAL. SEE DETAIL 2/ED1.1 FOR MORE INFORMATION.



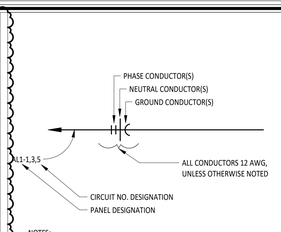
GENERAL NOTES:

A. MOUNTINGS SHOWN ARE TYPICAL. DETECTORS CAN BE INSTALLED SIDE, BOTTOM OR TOP OF DUCT AS LONG AS PROPER TUBE OPERATION AND FLOW/PRESSURE PERFORMANCE IS MAINTAINED.

B. DUCT DETECTOR SHALL, WHEN POSSIBLE, BE LOCATED A MINIMUM OF SIX DUCT WIDTHS DOWNSTREAM FROM A SOURCE OF TURBULENCE (BENDS, INLETS, OR DEFLECTION PLATES).

C. PROVIDE A REMOTE TEST SWITCH/ALARM MOUNTED IN CEILING OR 44" AFF ON WALL BELOW UNIT AND PROVIDE THE INTERCONNECTING WIRING. PROVIDE LABEL ON REMOTE SWITCH/ALARM INDICATING THE UNIT NAME AND DUCT DESCRIPTION OF UNIT SERVED.

3 E2.1 **DUCT DETECTOR DETAIL**
NTS



NOTES:

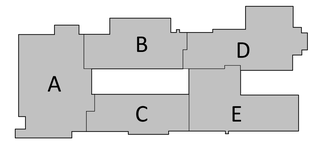
1. 12 AWG IS MIN. CONDUCTOR SIZE, EXCEPT AS NOTED.
2. 1/2" CONDUIT IS MIN. SIZE, EXCEPT AS CAPACITY PERMITTING 24 VOLT CONTROL CONDUCTOR.
3. PROVIDE DEDICATED NEUTRALS.

2 E2.1 **KEY TO ELECTRICAL CIRCUIT WIRING**
NTS

BRANCH CIRCUIT GENERAL NOTES:

1. CONDUIT ROUTING FOR BRANCH CIRCUITS ARE NOT SHOWN ON PLANS AND IS LEFT TO THE DISCRETION OF THE CONTRACTOR. THE FOLLOWING WIRE SIZES SHALL BE USED UNLESS NOTED OTHERWISE IN PANEL SCHEDULE. DETERMINE FURTHEST DISTANCE FROM BRANCH PANELBOARD TO FURTHEST DEVICE PRIOR TO WIRE INSTALLATION. INCREASE WIRE SIZE AS NECESSARY FOR FURTHER DISTANCES.

CIRCUIT TYPE	CONDUCTOR SIZE	MAXIMUM LENGTH
20A, 120V	10 AWG	100 FEET
20A, 120V	8 AWG	175 FEET
20A, 277V	10 AWG	200 FEET



KEY PLAN

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STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT

JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

GARMANN MILLER
MINSTER, OHIO | COLUMBUS, OHIO | INDIANAPOLIS, INDIANA | FORT WAYNE, INDIANA
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RENOVATION FOR
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11505 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS

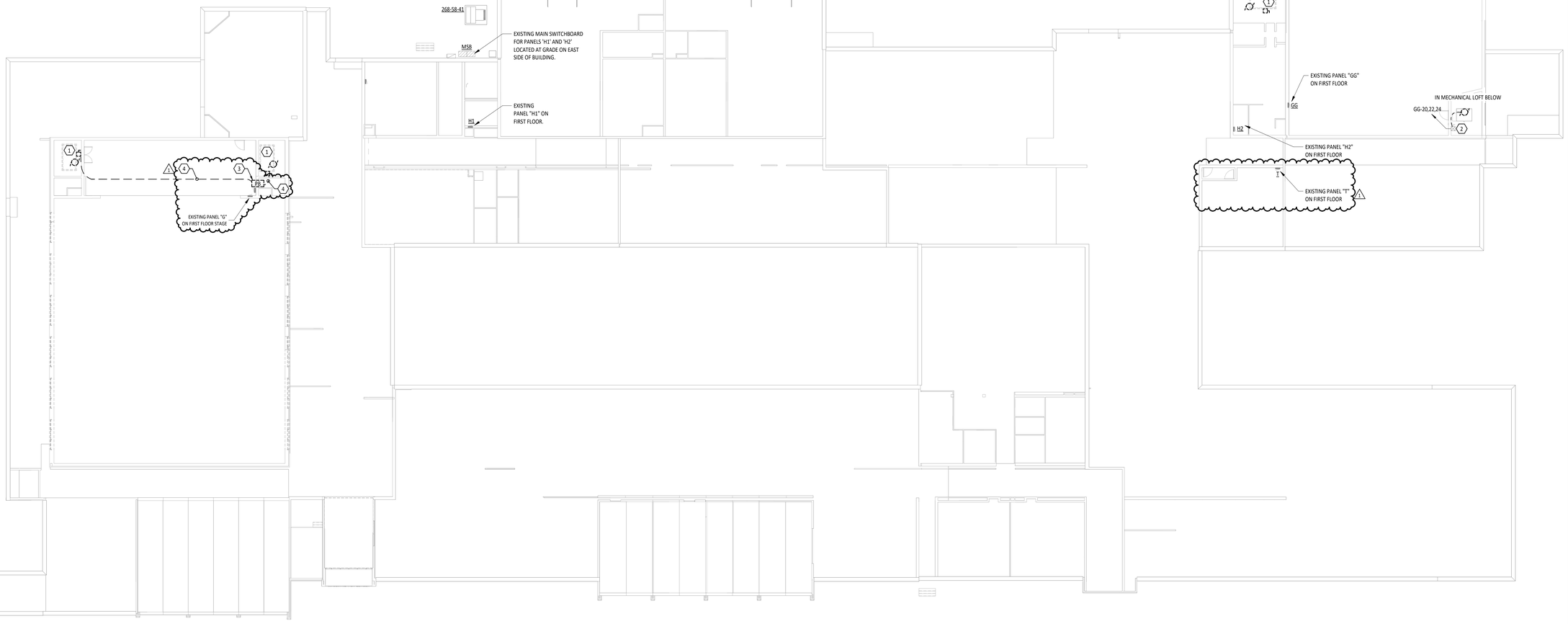
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	JDB	HJP

SHEET TITLE:
ELECTRICAL ROOF PLAN - OVERALL

SHEET NUMBER:
E2.1

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1 ED1.1 **OVERALL ELECTRICAL ROOF DEMOLITION PLAN**
1/16" = 1'-0"

POWER DEMOLITION GENERAL NOTES

A SEE ARCHITECTURAL AND MECHANICAL DRAWINGS AND SPECIFICATIONS FOR MORE INFORMATION REGARDING DEMOLITION AND CONSTRUCTION. COORDINATE WITH ALL TRADES ON THE PROJECT AT MAJOR PHASES OF CONSTRUCTION.

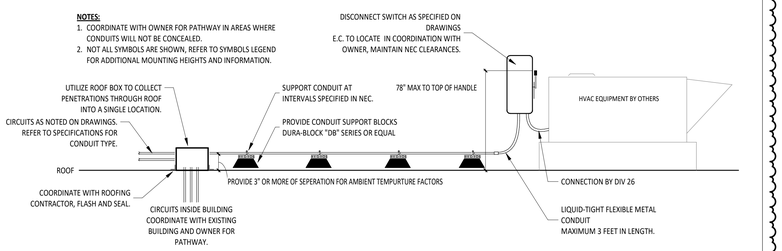
B DISCONNECT AND REMOVE ALL ELECTRICAL DEVICES AND LIGHTING FIXTURES IN DEMOLITION EQUIPMENT UNLESS OTHERWISE NOTED.

C FURNISH AND INSTALL CONDUIT AND WIRE AS NECESSARY FOR CONTINUITY OF ANY FEEDERS OR BRANCH CIRCUITS ORIGINATING OUTSIDE THE DEMOLITION AREA THAT SERVES ANY ELECTRICAL EQUIPMENT OR DEVICES TO REMAIN AFTER DEMOLITION. MODIFY OR REPLACE AS REQUIRED.

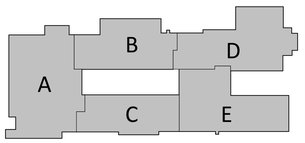
D FURNISH AND INSTALL CONDUIT AND/OR COMMUNICATIONS/DATA WIRING AS NECESSARY FOR CONTINUITY OF ANY WIRING ORIGINATING OUTSIDE THE DEMOLITION AREA THAT SERVES ANY COMMUNICATIONS/DATA EQUIPMENT OR DEVICES TO REMAIN AFTER DEMOLITION. MODIFY OR REPLACE AS REQUIRED.

E FURNISH AND INSTALL BLANK COVER PLATES OVER ALL EXISTING UNUSED OPENINGS.

#	KEYNOTE DESCRIPTION
1	REMOVE POWER FROM EXISTING ROOFTOP EQUIPMENT COMPLETE BACK TO SOURCE.
2	REMOVE POWER, REMOVE WIRING FROM UNIT BACK TO DISCONNECT SWITCH. ABANDON EXISTING CIRCUIT, TURN OFF ASSOCIATIVE BREAKER IN PANEL "GG". PROVIDE LABEL OR TAG INDICATING ABANDONED CONDITION.
3	REPLACE EXISTING BOX FOR RTU PATHWAYS. REFER TO NEW WORK PLANS FOR MORE INFORMATION.
4	REMOVE ROOF SURFACE CONDUIT AND INADEQUATE SUPPORTS.



2 ED1.1 **ELECTRICAL ROOF CIRCUIT DETAIL**
NTS



KEY PLAN

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STATE OF OHIO
JOHN T. MUSIELEWICZ 12800
REGISTERED ARCHITECT
JOHN T. MUSIELEWICZ
LICENSE #12800
EXPIRATION DATE: 12/31/2027

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GMDESIGNGROUP.COM

RENOVATION FOR
FAIRBANKS LOCAL SCHOOLS - GYM HVAC REPLACEMENT
11535 S.R. 38, Milford Center, Ohio 43045

ISSUANCES/REVISIONS		
	CONSTRUCTION DOCUMENTS	09/30/2026
1	ADDENDUM 01	10/12/2026

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
24045.03	JDB	HJP

SHEET TITLE:
ELECTRICAL ROOF DEMOLITION PLAN - OVERALL

SHEET NUMBER:
ED1.1