ADDENDUM NO. 01

February 9, 2026

Kalamazoo Public Schools Maple Street Magnet School For The Arts Office Renovation
922 W. Maple Street
Kalamazoo, MI 49008

TO: ALL BIDDERS OF RECORD

This Addendum forms a part of and modifies the Bidding Requirements, Contract Forms, Contract Conditions, the Specifications and the Drawings dated December 8, 2025, by TowerPinkster. Acknowledge receipt of the Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of Pages ADD 1-2 through ADD 1-1 and TowerPinkster Addendum No. 01, dated February 9, 2026, consisting of 131 pages.

A. SPECIFICATION SECTION 00 20 00 INFORMATION AVAILABLE TO BIDDERS

1. The Skillman Team will be visiting the Maple Street jobsite on Thursday, February 12, 2026, from 3:00 PM to 4:00 PM if any Contractors would like to attend. Please contact our Project Manager, Justin Douglas, at jdouglas@skillman.com, and our Project Engineer, Blake Lee, at blee@skillman.com.

B. **SPECIFICATION SECTION 01 12 00 MULTIPLE CONTRACT SUMMARY**

Paragraph 3.03 BID CATEGORIES

A. Bid Category No. 1 – General Trades

Add the following Clarifications:

1. **Bid Category No. 01 General Trades** to provide a temporary partition separating the occupied area from the construction area to be in place by August 21, 2026. Refer to attached sheet titled “Temporary Partition Plan”.

C. **SPECIFICATION SECTION 01 32 00 – SCHEDULES AND REPORTS**

a. 1.03 GUIDELINE SCHEDULE

Add:

1. See Guideline Schedule attached.
2. See Phasing Plan attached.

TowerPinkster

Architecture · Engineering · Interiors

ADDENDUM NO. 1

DATE OF ISSUANCE:	**February 9, 2026**
PROJECT:	**Maple Street Magnet School for The Arts Office Renovation** **922 W Maple Street** **Kalamazoo, MI 49008**
OWNER:	**Kalamazoo Public Schools**
ARCHITECT'S PROJECT NO.:	**23-626.00**
ORIGINAL BID ISSUE DATE:	**December 8, 2025**

SCOPE OF WORK

This Addendum includes changes to, or clarifications of, the original Bidding Documents and any previously issued addenda, and shall be included in the Bid. All of these Addendum items form a part of the Contract Documents. The Bidder shall acknowledge receipt of this Addendum in the appropriate space provided on the Bid Form. Failure to do so may result in disqualification of the Bid.

DOCUMENTS INCLUDED IN THIS ADDENDUM

This Addendum includes **Four (4)** pages of text and the following documents:

- Specification Sections:
  - **Div 23:** 23 0700, 23 2113, 23 2123, 23 2213, 23 2216, 23 2500, 23 5700
  - **Div 27:** 27 0553, 27 1116, 27 1513, 27 1700, 27 2626, 27 4116
  - **Div 28:** 28 1300, 28 1500, 28 2000
- Drawings: **G 001, MD 001A, MD 101A, M 200A, M 201A, M 501, M 601, ED 101A, E 100A, E 402, E 501, TG 001, TD 101A, T 101A, T 401, T 402, T 403, T 404, T 441**

CHANGES TO PREVIOUSLY ISSUED ADDENDA

None.

CHANGES TO SPECIFICATIONS

ADD-1 Item No. S-1 - Replace Heat Exchanger and Pump

Refer to Specification Section: 230700 HVAC Insulation

Add insulation information for steam and condensate piping.

Refer to Specification Section: 232113 Hydronic Piping

Add expansion tank and air separator.

Refer to Specification Section: 232123 Hydronic Pumps

Add section

Refer to Specification Section: 232213 Steam and Condensate Piping

Add section

Refer to Specification Section: 232216 Steam and Condensate Piping Specialties

Add section

Refer to Specification Section: 232500 HVAC Water Treatment

Add chemical feeder.

Refer to Specification Section: 235700 Heat Exchangers for HVAC

Add section

ADD-1 Item No. S-2 - Added Tech Specifications

Refer to Specification Section:

27 1116 Telecommunication Room Equipment and Racks

27 1513 Communications Copper Horizontal Cabling

27 1700 Testing, ID and Admin of Balanced Twisted Pair Infrastructure

27 2626 IP Address Request Form

27 4116 Integrated Audio Video Systems and Equipment

28 1300 Access Control

28 1500 Access Control Hardware Devices

28 2000 Video Surveillance

Added Tech Specifications to corresponding sheets that are included in this project.

CHANGES TO DRAWINGS

ADD-1 Item No. D-1 - Code Reference Update

Refer to Sheet(s): G 001

Changed Fuel and Gas code reference on drawing sheet G 001 from IFGC 2015 to IFGC 2021.

ADD-1 Item No. D-2 - Replace Heat Exchanger and Pump

Refer to Sheet[s]: MD 001A, MD 101A, M 200A, M 201A, M 501, M 601, ED 101A, E 100A, E 402, E 501

Add replacement of heat exchanger and pump.

Add demolition of hydronic piping.

Revise hydronic piping.

Add flow rates for balancing existing equipment.

Revise heating coil control valve type for HC-1.

Add temperature control valves and accessories required for heat exchanger and pump replacement.

Add heat exchanger sequence of operation.

Add demolition of existing equipment connection CP-1.

Add new equipment connection for new CP-1

Add conduit and feeder size for new CP-1

Panel schedule updated.

ADD-1 Item No. D-3 - Added Display and Data Drop to be demolished.

Refer to Sheet[s]: TD 101A, ED 101A

Added display with keyed note 11 and data drop with keyed note 5. Refer to the clouded devices on TD 101A. These are shown for reference only and will be performed by the technology contractor as part of a separate project.

TV display removed on ED 101A

ADD-1 Item No. D-4 - Updated Keyed Notes and Keyed Note Schedules

Refer to Sheet[s]: TD 101A, T101A

Updated keyed notes and keyed note schedule to include technology contractor and construction manager keyed notes.

ADD-1 Item No. D-5 - Removed Separate Project Callout Box

Refer to Sheet[s]: TG 001, TD 101A, T 101A, T 401, T 402, T 403, T 404

Removed callout box that stated sheets were for reference only.

ADD-1 Item No. D-6 - Added Access Control Detail Sheets

Refer to Sheet[s]: T 441

Added sheets with access control detailing that was not a part of the original package.

Changed sheet number T403 to sheet T 441 to reflect the general security nomenclature.

ADD-1 Item No. D-7 - Added AV Details Sheet

Refer to Sheet[s]: T 403

Added a sheet with typical classroom AV riser and schedule.

Moved the conference room AV rough in detail to T 403 from T 402.

ADD-1 Item No. D-8 - Added Additional Security Camera Rough in Details

Refer to Sheet[s]: T 402

Added security camera rough-in details. Refer to clouded rough-ins on T 402.

END OF ADDENDUM.

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation materials for HVAC systems.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

1. Mineral fiber.
2. Field installed jackets

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

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

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 COORDINATION

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

B. Coordinate clearance requirements with piping Installer for piping insulation application.

1. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

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

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

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

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

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1.
2. Provide ASJ or FSK for ductwork applications, as scheduled.

F. Mineral-Fiber, Preformed Pipe Insulation:

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

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

1. Provide ASJ or FSK for ductwork applications, as scheduled.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

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

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

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

D. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

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

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

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

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

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

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK Jacket Flashing Sealants:

1. Products:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

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

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

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

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

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

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

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, and mechanical joints.

2.8 TAPES

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

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

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

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

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

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

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

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

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch or 3/4 inch wide with wing or closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

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

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

F. Keep insulation materials dry during application and finishing.

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

H. Install insulation with least number of joints practical.

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

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

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

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

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

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

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

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

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

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

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations:

1. For applications requiring only indoor insulation, terminate insulation at roof structure and seal with joint sealant.

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

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

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

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

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

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

F. Insulation Installation at Floor Penetrations:

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

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.6 GENERAL PIPE INSULATION INSTALLATION

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

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

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For mineral fiber insulation, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

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

D. Insulation Installation on Control Valves:

1. Omit insulation over control valves.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

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

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

B. Insulation Installation on Pipe Flanges:

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

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

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

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, trapeze hanger bars, and duct flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of

elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

5. Insulate duct stiffeners, trapeze hanger bars, and duct flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.8 FIELD-APPLIED JACKET INSTALLATION

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

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
2. Fill inside of fitting jackets to prevent collapse of jacket.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation: Insulate the following in accordance with insulation schedule:

1. Supply air.
2. Outdoor air.
3. Return air.
4. Relief air.
5. Exhaust air.
6. Slot and linear diffuser plenums.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings, except as indicated.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Exposed supply and return metal ducts within rooms they are serving except mechanical rooms.
7. Exposed supply metal ducts within rooms they are serving down stream of fan coils and VAV terminal units except mechanical rooms.
8. Volume control balancing damper lever handles.

C. Definitions:

1. Concealed: Above continuous ceiling or enclosed with in a wall cavity
2. Exposed: In rooms with no ceilings or with partial ceilings (i.e. “cloud type ceilings”).
3. Finished Spaces: Spaces with room finishes and accessible by building occupants.
4. Unfinished Spaces: Spaces with no or limited room finishes and accessible by building maintenance or support staff only.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed outside, relief, supply and return air duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 1/5 inches thick and 0.75-lb/cu. ft.(12-kg/cu. m) nominal density.

B. Concealed exhaust-air duct and plenum insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2 1/5 inches thick and 0.75-lb/cu. ft.(12-kg/cu. m) nominal density.

C. Exposed outside, relief, supply and return air duct insulation within mechanical rooms shall be the following:

1. Mineral-Fiber Board with FSK Jacket (For Rectangular Applications): 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.
2. Mineral-Fiber Duct, Pipe and Tank with FSK Jacket (For Round or Flat Oval Duct Applications): 1-1/2 inches thick.

D. Exposed exhaust-air duct insulation within mechanical rooms between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Board with FSK Jacket (For Rectangular Applications): 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.
2. Mineral-Fiber Duct, Pipe and Tank with FSK Jacket (For Round Duct Applications): 1-1/2 inches thick.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable insulation materials and thicknesses are identified for each piping system and pipe size range.

1. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

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

1. Control valve stem and actuator.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F(16 Deg C):

1. All Pipe Sizes Exposed in Mechanical Rooms and Concealed Locations: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.

2. All Pipe Sizes Exposed in Finished Spaces: Insulation shall be following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick, NPS 1-1/4diameter and under; 2 inches thick, over NPS 1-1/4 diameter.

C. **Low Pressure Steam and Condensate(15 psi and less): Insulation shall be the following:**

1. **Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inch thick, under NPS 4diameter; 3 inchesthick, NPS 4 diameter and larger.**

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

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

B. Pipe Fittings with Mineral Fiber Insulation:

1. PVC Fitting Covers: 20 mils thick, white.

C. Exposed Vertical Piping within 8 feet of Floor shall be one of the following:

1. PVC: 30 mils thick, white.

END OF SECTION 23 0700

SECTION 23 2113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Condensate-drain piping.
3. Air-vent piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
2. Division 23 Section "Common Work Results for HVAC" for general piping materials and installation requirements.
3. Division 23 Section "Meters and Gages for HVAC Piping" for thermometers and pressure gages.
4. Division 23 Section "General Duty Valves for HVAC Piping" for general-duty ball, butterfly, and check valves.
5. Division 23 Section "Hangers and Supports for HVAC Equipment" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
6. Division 23 Section "Identification for HVAC Piping and Equipment" for labeling and identifying hydronic piping.
7. Division 23 Section "Instrumentation and Control for HVAC" for temperature-control valves and sensors.

1.2 ACTION SUBMITTALS

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

1. Pressure-seal fittings.
2. Calibrated Balancing Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
3. Hydronic specialties.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

C. Comply with the provisions of the following:

1. Michigan Mechanical Code

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. Wrought-Copper Fittings: ASME B16.22.

D. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Viega.
   b. NIPCO Press.
   c. Apollo “Xpress”

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

E. Wrought-Copper Unions: ASME B16.22.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.3 DIELECTRIC FITTINGS

A. Refer to Division 23 Section "Common Work Results for HVAC" for dielectric fittings.

2.4 VALVES

A. Check, and Ball Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

1. Valves with factory ends meeting requirements of Section “General Duty valves for Plumbing Piping” may be used in mechanical joint copper press systems**.**

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Furnished by temperature controls provider. Refer to Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.
   g. Tour & Andersson.
   h. Apollo Valves.
   i. Nexus.

2. Body: Bronze or DZR brass, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Drain Valves:

1. Ball-Valve-Type, Hose-End Drain Valves:
   a. Standard: MSS SP-110 for standard-port, two-piece ball valves.
   b. Pressure Rating: 400-psig minimum CWP.
   c. Size: NPS 3/4.

d. Body: Copper alloy.
e. Ball: Chrome-plated brass.
f. Seats and Seals: Replaceable.
g. Handle: Vinyl-covered steel.
h. Inlet: Threaded or solder joint.
i. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2. Gate-Valve-Type, Hose-End Drain Valves:
   a. Standard: MSS SP-80 for gate valves.
   b. Pressure Rating: Class 125.
   c. Size: NPS 3/4.
   d. Body: ASTM B 62 bronze.
   e. Inlet: NPS 3/4 threaded or solder joint.
   f. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.5 AIR CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Bell & Gossett.
   c. Armstrong Pumps, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. **Bladder-Type Expansion Tanks:**

1. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
   a. **Armstrong Pumps, Inc.**
   b. Bell & Gossett.

2. **Tank: Welded steel, rated for 125-psig(860-kPa) working pressure and 375 deg F(191 deg C) maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.**
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

C. **Enhanced Air Separator:**

1. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
   a. **Armstrong Pumps, Inc.**
   b. Bell & Gossett.

2. **Body: Cast iron body and cap with stainless steel internals.**
3. Air Outlet: Large capacity automatic air vent with non-ferrous internals.
4. Maximum Working Pressure: **150 psig**.
5. Maximum Operating Temperature: **250 deg F**.

2.6 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Terminal Unit Stainless-Steel Flexible Connectors (Duct coils, etc.):

1. Tubing: CPE/EPDM inner tube with stainless steel braided cover, fire rated.
2. End Connections: Brass or plated carbon steel fittings with swivel on one end.
3. Working Pressure Rating: 150 psig minimum.
4. Maximum Operating Temperature: 230 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 125 cast-iron or Class 150 malleable-iron threaded fittings.
3. Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-seal joints.

B. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type L, annealed-temper copper tubing with soldered or flared joints.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 drain valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings or where allowed, mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install strainers on inlet side of each in-line pump and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

S. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Install structural steel members between building structure members as required for upper attachment of hangers and supports. Use members of size and strength required for span and load. The use of joist or truss bridging for hanging and supporting is prohibited.

B. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. **Install air eliminator in pump suction. Install ball valve in blowdown connection.**

1. **Install piping from automatic air vent in top of air eliminator and extend full size to nearest floor drain.**

C. **Install bladder type expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to match system fill pressure.**

D. Install flexible hose connectors at inlet and discharge connections to ceiling mounted coil connections.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for test plugs and pressure gages at pumps and elsewhere as indicated according to Division 23 Section "Meters and Gages for HVAC Piping."

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections and elsewhere as indicated according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and bleed air completely.
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 2113

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. In-line pumps with ECM.

B. Related Sections include the following:

1. Division 23 Section "Common Motor Requirements for HVAC Equipment" for general motor requirements.
2. Division 23 Section "Meters and Gages for HVAC Piping" for pressure gauges requirements at pumps.

1.2 DEFINITIONS

A. Buna-N: Nitrile rubber.

1.3 ACTION SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

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

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Bell & Gossett.

2.2 WET ROTOR INLINE PUMPS

A. Basis of Design: Bell & Gossett Model ecocirc XL.

B. Description: Factory-assembled and -tested, wet rotor in-line pumps with ECM motor and integrated variable frequency drive.

1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Cast iron, with companion-flange connections.
3. Impeller: Plastic or stainless steel.
4. Shaft: Stainless steel.
5. Rotor: Permanent magnet.
6. Bearing: Carbon sleeve.
7. Gasket/O-Ring: EPDM.
8. All Other Wetted Parts: Stainless steel.
9. Motor Type: Electronically commutated motor /permanent magnet and includes:
   a. Class F motor insulation.
   b. Integrated motor protection against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).

10. Integrated Variable Frequency Drive: Tested as one unit by the manufacturer and includes:
    a. MODBUS or BACnet connections built into the VFD as standard.
    b. Analog inputs, such as 0-10V and 4-20mA inputs built into the VFD.

11. Maximum Working Pressure: 175 psi.
12. Maximum Working Temperature: 230°F.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install pressure gage across pump suction and discharge. Install single gage with metal tubing and multiple input selector valves.

F. Install electrical connections for power, controls, and devices.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:
    a. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    b. Verify that pump is rotating in the correct direction.
5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 2123

SECTION 23 2213 - STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fittings for steam and condensate piping:

B. Related Requirements:

1. Section 23 2216 "Steam and Condensate Piping Specialties" for strainers, steam traps, and thermostatic air vents and vacuum breakers.

1.2 DEFINITIONS

A. HP Systems: High-pressure piping operating at more than 15 psig as required by ASME B31.1.

B. LP Systems: Low-pressure piping operating at 15 psig or less as required by ASME B31.9.

1.3 ACTION SUBMITTALS

A. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to the following:

1. ASME Compliance: Comply with ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. LP Steam Piping: 125 psig.
2. Condensate Piping: 125 psig at 250 deg F.
3. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.

C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.

D. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.

E. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

F. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. LP Steam Piping, NPS 2 and Smaller: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. LP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. LP Condensate piping above grade, NPS 2 and smaller, shall be the following:

1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

D. Condensate piping above grade, NPS 2-1/2 and larger, shall be the following:

1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.2 ANCILLARY PIPING APPLICATIONS

A. Vacuum-Breaker Piping: Outlet, same as service where installed.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved.

B. Install piping at right angles or parallel to walls. Diagonal runs are prohibited unless otherwise indicated.

C. Install piping to permit valve servicing.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Install piping to allow application of insulation.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

I. Install drains, consisting of a tee fitting, NPS 3/4 full port high performance ball valve or globe valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

J. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

K. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

L. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

M. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.

N. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

O. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

P. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port high performance ball valve or globe valve, in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

Q. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for identifying piping.

R. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

S. Install sleeves, sleeve seals, and escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements in Section 23 0500 "Common Work Results for HVAC."

3.4 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION

A. Comply with requirements in Section 23 2216 "Steam and Condensate Piping Specialties" for installation requirements for steam and condensate specialties.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers and supports for steel steam supply and steam condensate piping in accordance Michigan Mechanical Code or MSS SP-69.

3.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install vacuum breakers downstream from control valve, close to coil inlet connection.

D. Install a drip leg at coil outlet.

3.8 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Perform the following tests and inspections:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

C. Prepare test and inspection reports.

END OF SECTION 23 2213

SECTION 23 2216 - STEAM AND CONDENSATE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following piping specialties for steam and condensate piping:

1. Strainers.
2. Steam traps.
3. Thermostatic air vents and vacuum breakers.

1.2 DEFINITIONS

A. LP Systems: Low-pressure piping operating at 15 psig or less as required by ASME B31.9.

1.3 ACTION SUBMITTALS

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

1. Steam trap.
2. Strainers
3. Air vent and vacuum breaker.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to the following:

1. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label..

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. LP Systems: 125 psig.
2. Condensate Piping: 125 psig at 250 deg F.
3. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.

4. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.

2.2 VALVES

A. General Duty Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Hoffman Specialty.
   c. Mueller Co.

2. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
4. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
5. Tapped blowoff plug.
6. CWP Rating: 250-psig working steam pressure.

2.4 STEAM TRAPS

A. Float and Thermostatic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Hoffman Specialty.
   c. Spirax Sarco, Inc.

2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
9. Maximum Operating Pressure: 125 psig.

B. Inverted Bucket Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Hoffman Specialty.
   c. Spirax Sarco, Inc.

2. Body and Cap: Cast iron.
3. End Connections: Threaded.
4. Head and Seat: Stainless steel.
5. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.
6. Bucket: Brass or stainless steel.
7. Pressure Rating: 250 psig.

2.5 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:

1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Hoffman Specialty.
   c. Spirax Sarco, Inc.

2. Body: Cast iron, bronze, or stainless steel.
3. End Connections: Threaded.
4. Float, Valve, and Seat: Stainless steel.
5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

B. Vacuum Breakers:

1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Hoffman Specialty.
   c. Spirax Sarco, Inc.

2. Body: Cast iron, bronze, or stainless steel.
3. End Connections: Threaded.
4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-Ring Seal: EPR.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping, unions, and flanges adjacent to specialties to permit servicing of specialties.

3.2 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment.

B. Install globe valve, strainer, and union upstream from trap; install union, check valve, and globe valve downstream from trap unless otherwise indicated.

END OF SECTION 23 2216

SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes HVAC water-treatment for the following systems:

1. Heating hot-water.
2. **Chemical Feed Tanks**.

1.2 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality.
2. Water Analysis: Illustrate water quality available at Project site.
3. Submit a written report of each system capacity in gallons as recorded from makeup water meter.
4. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sensors, injection pumps, and controllers.

1.5 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

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

1.6 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 SERVICE PROVIDER

A. Broadmoor Products, 1-800-884-6440

2.2 **MANUAL CHEMICAL-FEED EQUIPMENT**

A. **Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.**

1. **Capacity: 2 gal..**
2. Minimum Working Pressure: 125 psig.

2.3 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality requirements.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION - GENERAL

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install water testing equipment on wall near water chemical application equipment.

C. Provide piping and control connections between components. Coordinate power connections for components with Division 26.

3.3 **INSTALLATION OF BYPASS FEEDERS**

A. **Install bypass feeders in closed hydronic systems, and equipped with the following:**

1. **Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.**
2. Install an isolation valves on inlet, outlet, and drain below feeder inlet.
3. Install a swing check on inlet after the isolation valve.

3.4 CLEANING AND TREATMENT OF HYDRONIC SYSTEMS

A. Pre-Cleaning: Thoroughly flush all new piping and existing piping that was drained for this project with fresh water. Determine loop capacity in gallons using electric contact head type bronze constructed water meter. Fill system from completely dry to full, including air bleed out. Submit written report of system capacity in gallons taken from water meter. Drain system completely. Open drip legs and other non-flow piping to remove debris. Remove and clean all strainers.

B. Cleaning of Non-Glycol Systems: Refill system (new piping and existing piping that was drained) with fresh water along with alkaline detergent cleaner. Feed cleaner through bypass feeder at recommended use rates. Circulate 8 to 72 hours. Flush system. Open, clean, and inspect all strainers, drip legs, and non-flow areas. Refill with fresh water, bleed air from system, and allow system to make-up fresh water and bleed air until water leaving system is of same quality as make-up water.

C. Treatment of Non-Glycol Systems: Immediately introduce corrosion inhibitor through bypass feeder to protect the clean system.

D. Sectional Cleaning: If entire system is not cleaned and treated at one time, each untreated section shall be isolated from treated sections. Untreated sections to be cleaned and treated as described above ***before*** connection to a previously treated section. Provide written report for each individual section.

E. For non-glycol systems, perform tests determining analysis of supply water solution and submit written test results.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
    a. Test equipment (coils, heat exchangers, control valves, strainers, etc.) to verify water flow through equipment is not reduced due to debris caused by flushing and cleaning activities.
3. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
4. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
5. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
6. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
7. Repair leaks and defects with new materials and retest piping until no leaks exist.

B. Remove and replace malfunctioning components and retest as specified above.

END OF SECTION 23 2500

SECTION 23 5700 - HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes shell-and-tube and plate type heat exchangers.

1.2 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, performance, and dimensional requirements of heat exchangers and are based on the specific equipment indicated. Refer to Division 01 Section "Product Requirements."

B. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

PART 2 - PRODUCTS

2.1 SHELL-AND-TUBE HEAT EXCHANGERS

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

1. Bell & Gossett.

B. Configuration: U-tube with removable bundle.

C. Shell Materials: Steel.

D. Head:

1. Materials: Cast iron.
2. Flanged and bolted to shell.

E. Tube:

1. Seamless copper tubes.

2. Tube diameter is determined by manufacturer based on service.

F. Tubesheet Materials: Steel tubesheets.

G. Baffles: Steel.

H. Piping Connections:

1. Shell: Flanged or threaded inlet and outlet fluid connections, with threaded drain and vent connections.
2. Head: Threaded or flanged inlet and outlet fluid connections.

I. Support Saddles:

1. Fabricated of material similar to shell.
2. Foot mount with provision for anchoring to support.

PART 3 - EXECUTION

3.1 HEAT-EXCHANGER INSTALLATION

A. Install shell-and-tube heat exchangers on saddle supports.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for service and maintenance. Install piping connections to allow service and maintenance of heat exchangers.

1. For shell-and-tube heat exchangers, offset piping to allow tube pull.

C. Install shutoff valves at heat-exchanger inlet and outlet connections.

D. Install relief valves on heat-exchanger heated-fluid connection and pipe relief valves, full size of valve connection, to floor drain.

E. Install hose end valve to drain shell.

3.3 FIELD QUALITY CONTROL

A. Test units for leaks. Replace damaged equipment.

3.4 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION 23 5700

SECTION 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for labels and signs.
2. Labels.
3. Cable ties.
4. Hook & Loop (Velcro).
5. Fasteners for labels and signs.

1.2 ACTION SUBMITTALS

A. Labels

B. Hook & Loop (Velcro)

1.3 INFORMATIONAL SUBMITTALS

A. Installer Credentials:

1. BICSI TECH certification is required for the lead installer that will be onsite at all times.
2. Valid certificates shall be provided to TowerPinkster prior to project kick-off.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer shall have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by a BICSI TECH.
2. Installation Supervision: Installation shall be under the direct supervision of a BICSI TECH, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as a TECH to supervise on-site testing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. White letters on a Black field.

2.3 LABELS

A. Self-Adhesive Wraparound Labels: computer printed, 3-mil-thick, vinyl flexible labels with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof black ink marker recommended by tag manufacturer.
3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.
4. Handwritten labels are not approved.

B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:
   a. 1-1/2 by 6 inches for raceway and conductors
   b. 3-1/2 by 5 inches for equipment.
   c. As required by authorities having jurisdiction.

2.4 CABLE TIES

1. Cable ties are not allowed in any permanent installation.
2. Any cable tie used during installation, on a temporary basis, shall be removed prior to project completion.

2.5 HOOK & LOOP (VELCRO)

1. All cables to be bundled using Hook & Loop products (Velcro)
2. Panduit Part # HLS-75R0 or equal.

2.6 FASTENERS FOR LABELS AND SIGNS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Verify identity of each item before installing identification products.

C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

F. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

G. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label within 12 inches from each cable end.

H. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

3.2 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:
   a. Telecommunications.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:

1. Refer to detail drawings.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.

F. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

1. Fiber optic cables shall be labeled on each end within 12 inches of where fiber cable enters enclosure.

G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:

1. Refer to detail drawings.

H. Instructional Signs: Self-adhesive labels.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

J. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
3. Equipment to Be Labeled:
   a. Communications cabinets.
   b. Uninterruptible power supplies.
   c. Computer room air conditioners.
   d. Fire-alarm and suppression equipment.
   e. Egress points.
   f. Power distribution components.

END OF SECTION 27 0553

SECTION 27 1116 – TELECOMMUNICATION ROOM EQUIPMENT AND RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. 19-inch Equipment Racks.
2. Network Cabinets
3. Cable Management.
4. Rackmount Uninterruptable Power Supply (UPS).
5. Rackmount Power Distribution Unit (PDU).
6. Plywood Backboard.
7. Grounding.

1.2 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of a BICSI Technician.
2. Installation Supervision: Installation shall be under direct supervision of a BICSI Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as a RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL listed.

B. RoHS compliant.

C. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 19-INCH EQUIPMENT RACKS

A. Description: The data equipment rack shall meet EIA-310D standards and be constructed of extruded aluminum or steel capable of accepting 19" wide EIA equipment. Rack construction method shall ensure an electrically bonded structure for ease of grounding. The 3" channel rack shall be UL listed for 1000 lbs. load. The equipment mounting rails shall be double-sided #12-24 EIA universal mounting hole spacing. The equipment mounting rails shall include printed rack space identification on the front and back and be numbered up.

B. Manufacturers: Refer to drawing for manufacturer and part number.

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Floor-Mounted Racks:

1. Upright Depth: 3 inches
2. Two-Post Load Rating: 200 lb.
3. Number of Rack Units per Rack: 45.
4. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
5. Base shall have a minimum of four mounting holes for permanent attachment to floor.
6. Top shall have provisions for attaching to cable tray or ceiling.
7. Self-leveling.

2.3 NETWORK CABINETS

A. Description: Cabinets shall consist of a welded and assembled steel frame construction available in 600mm, 700mm, and 800mm widths, 1070mm and 1200mm depths and 42 RU, 45 RU, 48 RU, and 52 RU heights. The top of cabinet shall be available with either molded edge protection and snap-in covers for CoolBoot® Grommet Cable Seal or brush cable seal and rear lift-up lid for PDU cable lay-in. Fully adjustable front and rear cage nut equipment rails. Available options include front single hinged door and rear split-hinged doors with 80% open perforation, horizontally split side panels, cable management fingers, vertical cable manager bracket, PDU mounting bracket and casters. The entire cabinet shall be electrically bonded without the use of bonding wires. Cabinet shall have a 1591kg (3500 lbs.) static load rating and 1136kg (2500 lbs.) rolling load rating.

B. General Requirements:

1. Material: Steel with durable White polyester epoxy powder coat finish
2. Compliance: EIA/ECA-310-E, TIA/EIA-942, UL2416

C. Manufacturer: Refer to drawings for manufacturer and part number.

2.4 CABLE MANAGEMENT

A. Description: The vertical cable manager shall be a fully molded product shipped in two pieces for ease of handling. Each vertical cable manager shall have front and rear channels with covers.

B. Manufacturers: Refer to drawings for manufacturer and part number.

C. General Requirements:

1. Dual Sided Manager
2. Body Material: ABS
3. Orientation: Vertical
4. Cover Material: PVC
5. Overall Height: 83 inches
6. Overall Width: 6.7 inches
7. Overall Depth: 14.1 inches

2.5 RACKMOUNT UNINTERRUPTABLE POWER SUPPLY (UPS)

A. Manufacturers: Refer to drawings for manufacturer and part number.

2.6 RACKMOUNT POWER DISTRIBUTION UNIT (PDU)

A. Manufacturers: Refer to drawings for manufacturer and part number.

2.7 PLYWOOD BACKBOARD

A. Description: 4ft x 8ft plywood, ¾” thick on walls of Telecommunication Rooms.

B. General Requirements:

1. 4ft x 8ft
2. ¾" thick
3. A/C grade plywood with A side facing inside of Telecommunications Room
4. Each sheet of plywood to mounted vertically.
5. Refer to drawings for elevations.

2.8 GROUNDING

A. Comply with requirements in Section 27 0526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

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

1. Chatsworth Products, Inc.
2. Harger Lightning & Grounding.

C. Rack Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Rack-Mounted Horizontal Busbar: Designed for mounting in 19-inch equipment rack. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.

4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate PBB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind PBB. Connect PBB with a minimum No. 4 AWG grounding electrode conductor from PBB to suitable electrical building ground. Connect rack Busbar to near PBB.

1. Bond the shield of shielded cable to patch panel, and bond patch panel to PBB.

END OF SECTION 27 1116

SECTION 27 1513 – COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of copper horizontal cabling infrastructure as described on the Drawings and/or required by these specifications.

B. Section Includes:

1. CAT6 Cable.
2. CAT6 Termination Hardware.
3. CAT6 Patch Cables.
4. Labeling.
5. Certification Testing.
6. As-Built Drawings.
7. Grounding provisions for twisted pair cable.
8. Cable Manufacturer Warranty

1.2 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568.2-D requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.3 ACTION SUBMITTALS

A. Cabling Manufacturer Certified Installer Certificate

B. CAT6 Cable

C. CAT6 Termination Hardware

D. CAT6 Patch Cables

E. Shop Drawings: Reviewed by a current BICSI RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.

F. Twisted pair cable testing plan.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Credentials:

1. Each installer is required to be certified by the manufacturer of the products that are installed (i.e. Panduit, Belden, Hubbell, Commscope, Leviton, etc.)
2. BICSI TECH certification is required for the lead installer that will be onsite at all times.
3. Valid certificates shall be provided to TowerPinkster prior to project kick-off.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1. As-built Drawings.
2. Certification results for all installed cables (PDF & Certification tester format)
3. Cabling Manufacturer Warranty Certificate

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer shall have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by a BICSI TECH.
2. Installation Supervision: Installation shall be under the direct supervision of a BICSI TECH, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as a TECH to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency is required to have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as a TECH.

1.7 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568.1-D, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-E.

C. Grounding: Comply with TIA-607-D.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications Plenum Rated: Type CMP complying with UL 1685.
2. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. RoHS compliant.

2.3 CAT6 CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 350MHz.

B. Standard Compliances:

1. ANSI/TIA 568.2-D
2. NEC/CEC Type CMR (UL 1666) for Non-Plenum
3. NEC/CEC Type CMP (NFPA 262) for Plenum
4. UL Listed CMP-LP (0.5A) for Plenum
5. UL 444
6. RoHS Compliant Directive 2011/65/EU
7. ANSI/TIA 862 (Building Automation)
8. ICEA S-116-732
9. ICEA S-102-700
10. ISO/IEC 11801 Ed. 2.0 (Class E)

C. Applications

1. IEEE 802.3: 1000 BASE-T, 100 BASE-TX, 10 BASE-T, PoE, PoE+
2. ANSI/TIA 854: 1000 BASE-TX
3. CDDI, Token Ring, ATM
4. Digital Video
5. Broadband and Baseband Analog Video

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP).

F. Refer to drawings for cable manufacturer and part numbers.

2.4 CAT6 TERMINATION HARDWARE

A. Description: This section covers patch panels, jack modules, modular plugs, faceplates and surface mount boxes.

B. Patch Panels

1. Mounts to standard EIA 19" rack
2. All metal modular patch panels.
3. Stainless steel, painted black
4. Accept shielded and non-shielded jacks.
5. Write-on areas and option adhesive labels for port identification.
6. 24 and 48 port.
7. Flat and angled design.
8. Refer to drawings for manufacturer and part numbers.

C. Jack Modules

1. CAT6/Class E, 8-position
2. Exceeds channel requirements of ANSI/TIA-568.2-D Category 6 and ISO 11801 Class E standards at swept frequencies 1 to 250 MHz
3. Meets ANSI/TIA-1096-A contacts plated with 50 microinches of gold for superior performance
4. Rated for 2500 cycles with IEEE 802.3af / 802.3at and 802.3bt type 3 and type 4. Supports Power over HDBaseT up to 100 watts
5. Operating Temp: -10°C to 65°C (14°F to 149°F)
6. Terminate 4-pair, 22-26 AWG
7. 100 Ohm
8. Several available color options
9. Refer to drawings for manufacturer and part numbers.

D. Modular Plugs

1. CAT6/Class E, 8-position/8 wire
2. Exceeds ANSI/TIA Category 6 and ISO Class E performance requirements when properly terminated to CAT 6
3. Terminate 23-24 AWG (solid or stranded)
4. 100 Ohm
5. Supports PoE, PoE+, and proposed Type 3 and 4 PoE++ applications for up to 100 W

6. Refer to drawings for manufacturer and part numbers.

E. Faceplates - Plastic

1. Available in 1, 2, 3, 4 and 6 port single-gang
2. Optional label windows
3. Accepts variety of CAT6 jacks and AV inserts
4. Refer to drawings for manufacturer and part numbers.

F. Faceplates – Stainless Steel

1. Available in 2, 4 and 6 port single-gang
2. Optional label windows
3. Accepts variety of CAT6 jacks and AV inserts
4. Refer to drawings for manufacturer and part numbers.

G. Surface Mount Boxes

1. Low profile design
2. Variety of port densities
3. Accepts variety of CAT6 jacks and AV inserts
4. Breakouts for use with surface raceway
5. Made of ABS
6. UL 1863 rated
7. Refer to drawings for manufacturer and part numbers.

2.5 CAT6 PATCH CABLES

A. Description: Patch cord cable shall be offered in multiple colored UTP cable for design flexibility with a clear strain relief boot on each modular plug.

1. CAT6/Class E
2. Compatible with both T568A and T568B wiring schemes
3. Exceeds all ANSI/TIA-568.2-D and ISO 11801 Class E standards for all frequencies from 1 to 250 MHz
4. Meets ANSI/TIA-1096-A (formerly FCC Part 68); contacts plated with 50 microinches of gold for superior performance
5. UL 1863 approved
6. A variety of lengths shall be available for design flexibility.
7. PoE compliance: Rated for 2500 cycles with IEEE 802.3af / 802.3at and 802.3bt type 3 and type 4
8. Rated to 2500 mating cycles.
9. Field terminated patch cables shall not be allowed in any situation.
10. Refer to drawings for manufacturer and part numbers.

2.6 LABELING

A. Description: Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

2. All labels shall be installed on each end of installed cable within 12 inches of termination.
3. Labels shall be:
   a. Self-laminating vinyl labels
   b. Permanent acrylic tape that adheres to surfaces that are smooth, rough or powder coated
   c. Machine-printed labels indicating:
      1) Telecommunication Room
      2) Patch Panel
      3) Patch panel port

4. Hand-Written labels shall **NOT** be allowed in any situation.

2.7 AS-BUILT DRAWINGS

A. Description: Drawings submitted by contractor upon completion of project reflecting all changes made and documenting all installations.

1. As-built drawings shall be submitted to TowerPinkster for any/all structured cabling projects.
2. Each as-built shall indicate locations of all installed cables.
3. As-built drawing shall only have typed text (No hand-written as-builts).
4. As-builts shall be submitted in PDF format.
   a. Any other format requires approval prior to submittal.

2.8 GROUNDING PROVISIONS FOR TWISTED PAIR CABLING

A. Comply with requirements in Section 27 0526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-D.

2.9 CABLE MANUFACTURER WARRANTY

A. A cabling manufacturer warranty shall be provided by the installation contractor for all structured cabling projects.

1. Warranty shall be 25-year standards-based performance warranty that applies to all registered links and/or channels in an installation.
2. Warranty shall be submitted within 30 days of project completion.

PART 3 - EXECUTION

3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 27 0528 "Pathways for Communications Systems."

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

D. General Requirements for Cabling:

1. Comply with TIA-568.2-D.
2. Comply with BICSI's Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
13. Provide 5ft service loop at each location (security cameras & wireless access points shall have 15ft)
14. Bundle CAT6 cables in groups of no more than 24 cables as they route on ladder rack to patch panel in all exposed areas of Telecommunication Rooms.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.2 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.3 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-D and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.2-D.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 1513

SECTION 27 1700 - TESTING, ID. AND ADMIN OF BALANCED TWISTED PAIR INFRASTRUCTURE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

B. In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

C. In addition to the tests detailed in this document, the contractor shall notify the Owner or the Owner's representative of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge

1.2 SCOPE

A. This Section includes the minimum requirements for the test certification, identification and administration of horizontal balanced twisted pair cabling.

1.3 SECTION INCLUDES:

A. Copper cabling test instruments

B. Copper cabling testing

C. Identification

1. Labels and labeling

D. Administration

1. Test results documentation
2. As-built drawings

E. Testing shall be carried out in accordance with this document.

F. Testing shall be performed on each cabling link. (100% testing)

G. All certification tests shall be documented.

1.4 QUALITY ASSURANCE

A. All testing procedures and field-test instruments shall comply with applicable requirements of:

1. ANSI/TIA-1152, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
2. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises.
3. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
5. ANSI/TIA-606-C, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

B. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. Manufacturer of the connectors or cable.
2. Manufacturer of the test equipment used for the field certification.
3. Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida.

C. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.

1. The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.
2. The Owner or the Owner's representative will select a random sample of 5% of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Owner.

1.5 SUBMITTALS

A. Manufacturers catalog sheets and specifications for the test equipment.

B. A schedule (list) of all balanced twisted-pair copper links to be tested.

C. Sample test reports.

D. Certification results for all installed data cables.

1.6 ACCEPTANCE OF TEST RESULTS

A. Unless otherwise specified by the Owner or the Owners representative, each cabling link shall be in tested for:

1. Wire Map
2. Length
3. Propagation Delay
4. Delay Skew

5. DC Loop Resistance – recorded for information only
6. DC Resistance Unbalance – recorded for information only
7. Insertion Loss
8. NEXT (Near-End Crosstalk)
9. PS NEXT (Power Sum Near-End Crosstalk)
10. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
11. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
12. ACR-F (Attenuation to Crosstalk Ratio Far-End)
13. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
14. Return Loss
15. TCL (Transverse Conversion Loss) – recorded for information only
16. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only

B. All installed cabling Permanent Links shall be field-tested and pass the test requirements and analysis as described in Part 3. Any Permanent Link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected Permanent Link meets performance requirements. The final and passing result of the tests for all Permanent Links shall be provided in the test results documentation in accordance with Part 3.

C. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

PART 2 - PRODUCTS

2.1 BALANCED TWISTED-PAIR CABLE TESTERS

A. A The field-test instrument shall be within the calibration period recommended by the manufacturer, typically 12 months.

B. Certification tester

1. Accuracy
   a. Level III accuracy in accordance with ANSI/TIA-1152
   b. Independent verification of accuracy
   c. Acceptable manufacturers
      1) Fluke Networks or Ideal Networks

2. Permanent Link Adapters
   a. RJ45 plug must meet the requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568-C.2 Annex C
   b. Twisted pair Category 5e, 6, 6A, 7 or 7_A cords are not permitted as their performance degrades with use and can cause false Return Loss failures

3. Results Storage
   a. Must be capable of storing > 10,000 results for all measurements found in 2.1.B.4 below

4. Measurement capabilities
   a. Wire Map
   b. Length

c. Propagation Delay
d. Delay Skew
e. DC Loop Resistance
f. DC Resistance Unbalance
g. Insertion Loss
h. NEXT (Near-End Crosstalk)
i. PS NEXT (Power Sum Near-End Crosstalk)
j. ACR-N (Attenuation to Crosstalk Ratio Near-End)
k. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
l. ACR-F (Attenuation to Crosstalk Ratio Far-End)
m. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
n. Return Loss
o. TCL (Transverse Conversion Loss)
p. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
q. Time Domain Reflectometer
r. Time Domain Xtalk Analyzer

C. PC Software

1. Windows® based.
2. Must show when 3 dB and 4 dB rules are applied
3. Re-certification capability, where results must have their Cable IDs suffixed with (RC).
4. Built in PDF export – no additional third-party software permitted.
5. Built-in statistical analysis.

2.2 IDENTIFICATION

A. Labels

1. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
2. Shall be preprinted using a mechanical means of printing (e.g., laser printer).
3. Where used for cable marking, provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
4. Where insert type labels are used provide clear plastic cover over label.
5. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18” above all direct buried services, underground conduits and duct-banks.
6. Acceptable Manufacturers:
   a. Brady Corporation
   b. Silver Fox
   c. Brother
   d. Epson
   e. Dymo

2.3 ADMINISTRATION

A. Administration of the documentation shall include test results of each Permanent Link.

B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

C. The test result records saved within the field-test instrument shall be transferred into a Windows® -based database utility that allows for the maintenance, inspection and archiving of these test records.

PART 3 - PART 3 - EXECUTION

3.1 GENERAL

A. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

3.2 BALANCED TWISTED PAIR CABLE TESTING

A. Field-test instruments shall have the latest software and firmware installed.

B. Permanent Link test results including the individual frequency measurements from the tester shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

C. Testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.

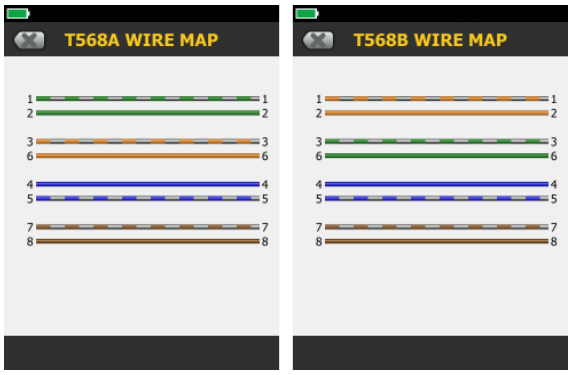
D. Permanent Link adapters made from twisted pair Category 5e, 6, 6A, 7 or 7_A cords are not permitted as their performance degrades with use and can cause false Return Loss failures.

E. The installer shall build a reference link. All components shall be anchored so it is not possible to disturb them. The technician is to conduct a Category 6 Permanent Link test each day to ensure no degradation of the tester or its Permanent Link adapters.

F. Wire Map Measurement

1. The wire map test is intended to verify pin-to-pin termination at each end and check for installation connectivity errors. For each of the 8 conductors in the cabling, the wire map indicates:
   a. Continuity to the remote end
   b. Shorts between any two or more conductors
   c. Reversed pairs
   d. Split pairs
   e. Transposed pairs
   f. Distance to open on shield
   g. Any other miss-wiring

2. The correct connectivity of telecommunications outlets/connectors is defined in ANSI/TIA-568-C.2. Two color schemes are permitted. The user shall define which scheme is to be used. The field tester shall document which color scheme was used. Examples are given below:

3. 

G. Length Measurement

1. The length of each balanced twisted pair shall be recorded.
2. Since physical length is determined from electrical length, the physical length of the link calculated using the pair with the shortest electrical delay shall be reported and used for making the pass or fail determination.
3. The pass or fail criteria is based on the maximum length allowed for the Permanent Link as specified in ANSI/TIA-568-C.2 plus the nominal velocity of propagation (NVP) uncertainty of 10%. For a Permanent Link, the length measurement can be 325 ft. (99 m) before a fail is reported.

H. Propagation Delay measurement

1. Is the time it takes for a signal to reach the end of the link.
2. The measurement shall be made at 10 MHz per ANSI/TIA-1152.
3. The propagation delay of each balanced twisted pair shall be recorded.
4. Is not to exceed 498 ns per ANSI/TIA-568-C.2 Section 6.3.18.

I. Delay Skew measurement

1. Is the difference in propagation delay @ 10 MHz between the shortest delay and the delays of the other wire pairs.
2. The delay skew of each balanced twisted pair shall be recorded.
3. Is not to exceed 44 ns per ANSI/TIA-568-C.2 Section 6.3.19.

J. DC Resistance

1. Often reported as Resistance, is the loop resistance of both conductors in the pair.
2. Is not specified in ANSI/TIA-1152 but shall be recorded for all four pairs.

K. DC Resistance Unbalance

1. Often reported as Resistance Unbalance, is the difference in resistance of the two wires within the pair.
2. Is not specified in ANSI/TIA-1152 for a Permanent Link but shall be recorded for all four pairs.

L. Insertion Loss

1. Is the loss of signal strength over the cabling (in dB).
2. The frequency resolution shall be:

a. 1 – 31.25 MHz: 150 kHz
b. 31.25 – 100 MHz: 250 kHz
c. 100 – 250 MHz: 500 kHz

3. Worst case shall be reported for all four pairs in one direction only.
4. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
5. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.7.

M. NEXT (Near-End Crosstalk)

1. Is the difference in amplitude (in dB) between a transmitted signal and the crosstalk received on other wire pairs at the same end of the cabling.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz

3. Shall be measured in both directions. (12 pair to pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.8.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
7. The Time Domain Xtalk data shall be stored for any marginal or failing NEXT results.

N. PS NEXT (Power Sum Near-End Crosstalk)

1. Is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the same end of the cabling.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz

3. Shall be measured in both directions. (8 pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.9.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
7. The Time Domain Xtalk data shall be stored for any marginal or failing PS NEXT results.

O. ACR-N (Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz

3. Shall be calculated in both directions.
4. Is not specified in ANSI/TIA-1152 but shall be recorded for all 12 possible combinations.

P. PS ACR-N (Power Sum Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of PS NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be calculated in both directions.
4. Is not specified in ANSI/TIA-1152 but shall be recorded for all 8 possible combinations.

Q. ACR-F (Attenuation Crosstalk Ratio Far-End)

1. Is a calculation of FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be measured in both directions. (24 pair to pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.11.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

R. PS ACR-F (Power Sum Attenuation Crosstalk Ratio Far-End)

1. Is a calculation of PS FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be measured in both directions. (8 pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.13.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

S. Return Loss

1. Is the difference (in dB) between the power of a transmitted signal and the power of the signals reflected back.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be measured in both directions. (8 pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Shall be ignored at all frequencies where the Insertion Loss is less than 3 dB for that pair.

6. Is not to exceed the Category 6 Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.6.
7. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
8. The Time Domain Reflectometer data shall be stored for any marginal or failing Return Loss results.

T. TCL (Transverse Conversion Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the near-end on the same wire pair.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be measured in both directions.
4. Is not specified in ANSI/TIA-1152 for a Permanent Link but shall be recorded for all 8 possible combinations.

U. ELTCTL (Equal Level Transverse Conversion Transfer Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the far end on the same wire pair minus the Insertion Loss of that pair.
2. The frequency resolution shall be:
   a. 1 – 31.25 MHz: 150 kHz
   b. 31.25 – 100 MHz: 250 kHz
   c. 100 – 250 MHz: 500 kHz
3. Shall be measured in both directions.
4. Is not specified in ANSI/TIA-1152 for a Permanent Link but shall be recorded for all 8 possible combinations.

3.3 ADMINISTRATION

A. Test results documentation

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period and shall be passed to the Owner's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.
3. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD or DVD prior to Owner acceptance of the building. This CD or DVD shall include the software tools required to view, inspect, and print any selection of the test reports.
4. Circuit IDs reported by the test instrument should match the specified label ID (see **Error! Reference source not found.** of this Section).

5. The detailed test results documentation data is to be provided in an electronic database for each tested balance twisted-pair and shall contain the following information
   a. The overall Pass/Fail evaluation of the link-under-test
   b. The date and time the test results were saved in the memory of the tester
   c. The identification of the customer site as specified by the end-user
   d. The name of the test limit selected to execute the stored test results
   e. The name of the personnel performing the test
   f. The version of the test software and the version of the test limit database held within the test instrument
   g. The manufacturer, model and serial number of the field-test instrument
   h. The adapters used
   i. The factory calibration date
   j. Wire Map
   k. Propagation Delay values, for all four pairs
   l. Delay Skew values, for all four pairs
   m. DC Resistance values, for all four pairs
   n. DC Resistance Unbalance, values for all four pairs
   o. Insertion Loss, worst case values for all four pairs
   p. NEXT, worst case margin and worst case values, both directions
   q. PS NEXT, worst case margin and worst case values, both directions
   r. ACR-F, worst case margin and worst case values, both directions
   s. PS ACR-F, worst case margin and worst case values, both directions
   t. Return Loss, worst case margin and worst case values, both directions
   u. TCL, worst case values both directions
   v. ELTCTL, worst case values, both directions.
   w. Time Domain Crosstalk data if the link is marginal or fails
   x. Time Domain Reflectometer data if the link is marginal or fails

B. Record copy and as-built drawings

4. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on a CD or DVD. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:
   a. Field directed changes to pull schedule.
   b. Horizontal cable routing changes.
   c. Associated detail drawings.

END OF SECTION 27 1700

IP ADDRESS REQUEST FORM

Request Date: Install Deadline:

Company: Contact Name:

Contact Phone: Contact Email:

Building/Location: Project Number:

Request Type (SELECT ONE – USE SEPARATE FORM FOR EACH REQUEST)

☐ Connection / Configure Existing Data Drop

☐ New Data Cable Installation

☐ VPN / Remote Access

Connect / Configure Existing Data Drop:

Purpose / Description for Connected Device (Lighting Control, AV Equipment, Electrical Equipment, Printer, Etc.):

_____

Number of Devices or Switch Ports Required: _____

Number of Ports That Require Poe: _____

Device Location / Room #: _____

Data Drop ID: _____

Does the Device Require A Static IP Address? ☐ YES ☐ NO

Add New Data Cable:

Purpose / Description for New Data Cable:

_____

Number of Data Cables to Add: _____

Number of Ports Requiring Poe: _____

Device Location / Room #: _____

Does the Device Require A Static IP Address? ☐ YES ☐ NO

VPN / Remote Access:

Purpose / Description for Connected Device:

_____

Server Name or Equipment IP Address That Requires Remote Access:

_____

Your Company's Public IP Address That You Will Be Connecting From: _____

Signatures

Requester Signature: _____ Date: _____

Owner Authorization Signature: _____ Date: _____

SECTION 27 4116 – INTEGRATED AUDIO VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Work includes the following, as described in this Specification document, associated project drawings and any subsequent addenda:

1. Existing technology demolition work
2. Provision of professional systems engineering and programming services.
3. Provision of accurate and timely project management, including, but not limited to:
    a. Implementation scheduling
    b. Coordination with Owner, Construction Manager, Technology Consultant and other trades
    c. Problem identification and resolution
    d. Installation coordination at site(s)
    e. Configuration and programming coordination
    f. Coordination of testing
    g. Coordination of Owner orientation
    h. Assembly and delivery of project documentation
    i. Accurate and timely delivery of administrative documentation
        1) Project schedules
        2) Project status reports
        3) Pay applications
        4) Other as requested
4. Receipt and storage of all equipment on behalf of the Owner.
5. Transportation of all equipment to designated locations.
6. Provision of complete and fully functional audio video systems.
7. Provision of complete trash removal and recycling services.
8. Provision of complete project documentation.
9. Provision of product orientation services.

1.2 RELATED DOCUMENTS

A. Project drawings

1.3 STANDARDS & GUIDELINES

1. Audiovisual design and installation practices shall comply with the following standards issued by AVIXA (Audiovisual and Integrated Experience Association) and ANSI/INFOCOMM
2. INFOCOMM 2014 - AV/IT Infrastructure Guidelines for Higher Education.
3. AVIXA A102.01:2017 - Audio Coverage Uniformity in Listener Areas.
4. AVIXA F501.01:2015 - Cable Labeling for Audiovisual Systems.
5. AVIXA V202.01:2016 - Display Image Size for 2D Content in Audiovisual Systems.
6. ANSI-J-STD-710 - 2015 - Audio, Video and Control Architectural Drawing Symbols

7. ANSI/INFOCOMM 2M-2010 - Standard Guide for Audiovisual Systems Design and Coordination processes.
8. ANSI/INFOCOMM 3M-2011 - Projected Image System Contrast Ratio
9. ANSI/INFOCOMM 4:2012 - Audiovisual Systems Energy Management.
10. ANSI-INFOCOMM 10:2013 - Audiovisual Systems Performance Verifications.

1.4 ACTION SUBMITTALS

A. Product Data: Submit applicable product information sheets for all products. Information sheets that include details for multiple model numbers, Contractor shall circle, or otherwise highlight, the applicable model number, color, other defining characteristic for the product being supplied.

1. Video display equipment (electronics, mounts and screens)
2. Enclosures/furniture (racks, enclosures, podiums)
3. Control system equipment (processors/user interfaces)
4. Audio system (amplifiers, mixers, speakers, microphones, antennas)
5. AV signal routing equipment (switchers, distribution amplifiers, transmitters, receivers)
6. I/O connection interface equipment (wallplate and floor box hardware)
7. Ethernet equipment (AV related)
8. Video conference equipment (codec, camera, interfacing)
9. Source equipment (AV sources)
10. All cabling & termination hardware

B. Installer Certifications: Submit manufacturer training certifications for installers.

1. 1. Atlona Level 100: Atlona Technology Specialist

C. 2. Atlona Level 200: Atlona Certified Technologist Shop Drawings: Submit assembly and installation layout drawings showing product components in assembly with adjacent materials and products (speakers, panels, microphones, electronics rack, enclosure, etc.).

D. Operation and Maintenance Data.

1. Not applicable

E. Warranty: Submit manufacturer's standard warranty statement. Submit Contractor statement of project warranty.

1.5 APPROVED PRODUCTS

A. Certain products, detailed in the project drawings, are specified by manufacturer and model number. These products shall be included in base bid proposals. Voluntary alternates shall be considered but are be submitted as a separate proposal (i.e. -not as part of base bid submittal). Alternate solutions will not be pre-evaluated or pre-approved.

B. Audio Video system-type designation symbols are defined on technology floorplans and detail sheets of the project drawings. Audio Video systems are designated as system types. System types are designated as AV[#]. Each AV System Type has a detailed riser diagram, included in the project drawings of this bid package, which indicates required major hardware and cabling for the system. Detailed manufacturer and part number is detailed on a AV System Product Key. Refer to project drawings.

1.6 AUDIO VIDEO SYSTEM DEFINITION & DETAIL

A. Project drawings include detail to indicate intended device locations and intended signal flow/functionality.

B. Contractor is responsible for including any/all devices, cables, adapters and accessories to provide complete and functional systems. Project drawings include riser diagrams, notes and details to indicate the intended signal flow and overall functionality. The Contractor shall supply all needed parts for functional systems, regardless of whether all parts are indicated on project drawings.

1.7 OVERALL PROJECT OVERVIEW

A. This project consists of demolition of existing AV systems and the installation of new AV systems in classrooms, cafeteria, auditorium, conference rooms and miscellaneous educational room spaces. Detailed demolition and new technology floorplans are provided as part of the project drawings. This is a multi-phase construction project. Unless otherwise noted, the Contractor shall provide all technology hardware. Certain system types have various “Owner Furnished Equipment”. This equipment shall be provided by the Owner, to the Contractor. Contractor shall install this equipment.

1.8 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Minimum 5 years’ experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.

B. Installer Qualifications: Installation, disassembly, re-assembly and calibration shall be done by manufacturer-trained and certified installation technicians. Assigned site Project Manager (Site Foreman) shall have a minimum of 5 years’ experience managing/supervising projects of similar size and complexity.

C. MATERIALS

1. Source Limitations: Obtain components and accessories direct from manufacturer or manufacturer-authorized distributor. Sourced product shall carry full manufacturer warranty support.
2. All supplied products must be new. Remanufactured or refurbished product shall not be utilized.
3. All supplied products must be new. Remanufactured or refurbished product shall not be utilized.
4. Electrical Components: Listed and labeled per NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction.

D. STANDARDS COMPLIANCE

1. Comply with the latest edition, revision or current guideline of each standard code (or best practice) as published by the following entities:
   a. American Institute of Architects (AIA)
   b. American National Standard Institute (ANSI)
   c. American Society for Testing and Materials (ASTM)
   d. Audiovisual and Integrated Experience Association (AVIXA)
   e. Building Industry Consulting Service International (BICSI)
   f. Electronics Industries Association (EIA)
   g. Federal Communications Commission (FCC)
   h. Federal Information Processing Standards (FIPS)

i. HDBaseT Alliance (HDBaseT)
j. Institute of Electrical and Electronics Engineers (IEEE)
k. National Electrical Manufacturers Association (NEMA)
l. National Fire Protection Association (NFPA)
m. National Electrical Code (NEC)
n. National Electrical Manufacturers Association (NEMA)
o. National Institute of Standards and Technology (NIST)
p. National Systems Contractors Association (NSCA)
q. Occupational Safety and Health Administration (OSHA)
r. Product Manufacturers within this Specification
s. State and Local Municipality Code and Ordinances
t. Telecommunications Industries Association (TIA)
u. Underwriters' Laboratories (UL)

E. CURRENT VERSIONS

1. All products supplied shall be of the latest revision available at the time of Contract.

F. FIRMWARE

1. All products supplied shall have the latest firmware revision available at the time of Contract and be updated to the latest firmware revision just prior to commissioning and closeout.
2. Contractor shall provide and perform critical firmware updates on supplied products throughout the project warranty period. Critical updates are defined as any firmware update to correct any issue that causes the product to not function as intended resulting in a non-functional system. Non-critical firmware updates shall be postponed until just prior to commissioning and closeout.
3. All firmware updates shall be performed by Contractor, without charge to Owner, throughout project warranty period.

G. SOURCE CODE AND CUSTOM PROGRAMMING

1. For systems utilizing control system source code and or custom program/configuration files, Contractor shall supply, and transfer ownership of, all programs/files to the Owner as part of project Close-out Documentation. These files shall include, but not be limited to: uncompiled and compiled source code, customized modules, login credential documentation, etc. Any/all files and information, required to alter, update or change programming, shall be supplied to the Owner.

1.9 DELIVERY, STORAGE AND HANDLING

A. Pack and ship in accordance with manufacturer's recommendations:

1. Finish, assemble, and test all components in the factory before shipment.
2. Rack components will be sub assembled before delivery to jobsite.
3. Deliver components to room designated for installation.

B. Do not accept damaged products at the site. Do not install damaged products.

C. Store products in heated indoor storage near point of installation. Retain protective packaging until installing. Ship to jobsite only after roughing-in, painting work, and other related finish work has been

completed and installation areas are ready to accept units and recommended temperature and humidity levels will be maintained during the remainder of construction

1.10 PROJECT CONDITIONS

A. Environmental Requirements: Do not install system until all mortar, wet and dust producing trades have completed their work and finished floor is in place.

B. Confirm all installation locations prior to start of work.

C. Where code permits, wiring may be run outside of conduit. Such wiring shall be coordinated either in a plenum space or by means of secondary enclosure that meets code requirements.

D. Field Measurements: Obtain required field measurements and indicating performance setups, ceiling construction, wall construction, ventilation features, electrical systems, networks and potential obstacles on shop drawings.

1.11 WARRANTY

A. Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of system that fail in materials or workmanship from date of Substantial Completion for the number of years indicated below.

1. Parts and labor project warranty shall be one (1) year, effective at date of project completion as determined by Owner sign-off of final pay application. Project warranty shall include all costs to troubleshoot and repair any/all reported problems reported during the project warranty period.

1.12 INSTALLATION

A. Contractor shall install, calibrate and tune system for preset environments determined by customer.

B. Contractor shall install a complete “pilot” system, to be evaluated by the Owner and Technology Consultant, prior to mass-installation of additional systems. Owner and Technology Consultant will evaluate installation methods and product configuration/programming. Once approved, Contractor may proceed with remaining system installations.

C. Calibrate systems for proper operation.

D. Refer to project drawings.

1.13 DEMONSTRATION

A. Train Owner's personnel to operate and maintain systems.

B. Include time to train owner’s representative.

C. Turn over operation and instructions to Owner.

1.14 CLOSEOUT SUBMITTALS

A. Submittal format

1. (2) USB media for:
   a. Owner
   b. Technology Consultant

B. Maintenance data.

C. Inventory data (Excel spreadsheet).

1. By Building and Room:
   a. Each product:
      1) Manufacturer
      2) Product name
      3) Model number
      4) Serial number
      5) MAC address (if applicable)
      6) IP address (if applicable)
      7) Network Name (if applicable)
      8) Owner asset tag number (if applicable)

D. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. This shall include non-compiled source code including any program module custom to the project. All login credentials required to open/access code and modules shall be supplied.
3. Printout of software application and graphic screens.

E. Source Code and/or equipment configuration files

F. As-Built diagrams/drawings

G. Provide (2) copies of all Closeout Submittals (one to Owner and one to Technology Designer)

1.15 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

1.16 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-C and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

1.17 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 27 0553 "Identification for Communications Systems."

B. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
   b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

C. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

1.18 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-D.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

4. All CAT6 cables shall be certified in accordance with specification 27 1700 TESTING, IDENTIFICATION AND ADMINISTRATION OF BALANCED TWISTED PAIR INFRASTRUCTURE.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Ensure EDID compliance between source and sink devices. For systems utilizing multiple displays of disparate resolutions, an EDID documentation plan shall be created prior to installation. Switchers, distribution amplifiers, and/or other distribution hardware that are intermediary between source and sink, shall be properly configured to maintain proper EDID per industry best-practice.

E. Ensure HDCP compliance between source and sink devices. Switchers, distribution amplifiers, and/or other distribution hardware that are intermediary between source and sink, shall be properly configured to maintain proper HDCP key “handshake” per industry best-practice.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 27 4116

SECTION 28 1300 - ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Failure to consult these documents shall not relieve the Contractor of the requirements therein.

1.2 SUMMARY

A. This Section includes the following:

1. Security Access Devices.
2. Access Control Panel.
3.

1.3 RELATED SECTIONS

A. Division 27 Section "Communications" for connections to the LAN.

B.

1.4 REFERENCES

A. ANSI A117.1 (1998) - Accessible and Usable Buildings and Facilities.

B. IBC 2009 - International Building Code.

C. NFPA 70 (2008) - National Electrical Code.

D. NFPA 80 - Fire Doors and Windows.

E. NFPA 101- Life Safety Code.

F. UL 294 - Access Control Systems.

G. UL 1076 - Proprietary Burglar Alarm Units and Systems.

H. Local applicable codes.

1.5 SYSTEM DESCRIPTION

A. Security Access System.

1. Selected Exterior Doors: Control access into Building.
2. Selected Building Areas: Control access into selected areas indicated.
3. System shall be compatible with existing Tridium system.

1.6 SUBMITTALS

A. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required.

B. Product Data: Provide electrical characteristics and connection requirements.

C. Test Reports: Indicate satisfactory completion of required tests and inspections.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of access authorization equipment.

F. Operation Data: Operating instructions.

G. Maintenance Data: Maintenance and repair procedures.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty years documented experience and with service facilities within 100 miles of Project.

C. Installer Qualifications: Company specializing in installing the products specified in this section with minimum Installer Qualifications: Systems Integrators, verifiably factory trained and certified by the primary product manufacturers, with documented experience installing complete integrated access control systems similar in material, design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance. Qualifications include, but are not necessarily limited, to the following:

1. References: Provide a list of references for similar projects including contact name, phone number, name and type of project.
2. Professional Staffing: Firms to have a dedicated access control systems integration department with full time, experienced professionals on staff experienced in providing on site consulting services for both electrified door hardware and integrated access control systems installations.
3. Factory Training: Installation and service technicians are to be competent factory trained and certified personnel capable of maintaining the system.
4. Service Center: Firms to have a service center capable of providing training, in-stock parts, and emergency maintenance and repairs at the Project site with 24-hour/7-days a week maximum response time.
5.

D. Supplier Qualifications: Supplier/Dealers, verifiably authorized and in good standing with the primary product manufacturers, with experience supplying integrated access control systems similar in material,

design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article will not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of the installed access control system hardware and software that fails in materials or workmanship, including all related parts and labor, within specified warranty period after final testing and acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the National Burglar & Fire Alarm Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to Owner's insurance underwriter.

E. Testing Agency's Field Supervisor: Person currently certified as an advanced alarm technician by the National Burglar & Fire Alarm Association to supervise on-site testing specified in Part 3.

1.9 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (12) months full maintenance by skilled employees of the Systems Integrator. Include repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

B. EXTRA MATERIALS

C. Provide thirty (30) key cards.

PART 2 - PRODUCTS

2.1 OVERVIEW

A. The devices described herein are intended to provide a reference for the Card Access/Security System and are to be provided as described in the Contract Documents.

B. Certain devices described may not be applicable to all systems. All devices required to complete the installation may not be described but shall be provided as if specifically called for within the Specification. It is the responsibility of the Contractor to provide a complete working system.

C. All system components shall be approved for the function they will perform.

D. The system shall be of an open architecture design and shall support industry standard databases such as Microsoft SQL Server 2000/2005, MSDE or SQL Server 2005 Express.

E. A system server for enterprise wide database services, system programming, system monitoring, administrative services, report and proximity card generation.

F. A workstation computer shall provide interfacing and control of the local, site specific, Access/Security System.

G. The System shall be of a distributed database design, using intelligent microprocessor panels, to make smart decisions at the door.

H. The system shall be capable of utilizing a true client server network configured to support the system database service, all panel services and user interfaces optimizing the users' options for system programming, event monitoring and record keeping.

I. The database service shall be ODBC compliant allowing the system to access an existing compatible ODBC compliant database as the system data source. A single system database shall maintain both credential-holder's records as well as access system information and programming parameters.

2.2 MANUFACTURERS

A. Manufacturers subject to compliance with requirements, provide products by the manufacturers specified.

1. Access Control System - Tridium
2. Card Readers – HID or approved equivalent.
3. Proximity Cards – Cards will be furnished by Owner and will be 26 bit, HID compatible.
4. Substitutions: Refer to Division 01 Section "Product Requirements".

2.3 ACCESS CONTROL PANEL

A. The access control panel shall be an intelligent, modular controller designed to integrate various event management applications on one controller. The system is an existing Tridium system. All new components shall match existing hardware.

B. COMPONENTS

1. Primary Controller: The Primary Controller is the controller responsible for up/downstream communications with the PC/Network. The Primary Controller consists of three major subsystems, software services, hardware and expansion interfaces.
   a. Software Services: The software services are a set of common functions and applications that shall be installed on every Controller to perform system configuration, generic system event handling and communications between the controller and a host or other controllers.
   b. Hardware

1) Ethernet Port: The Controller shall support 10BaseT Ethernet Communication. The interface to the Ethernet services shall be through a standard RJ-45 jack connector native to the controller. Provide as many as required for full system integration.
2) Serviceable Hot-Swap Modules: The Controller shall allow for "Hot-Swap" serviceability. This allows for communications and door modules to be interchanged without a controller power-down.
3) Power Requirements: Each 600 Series Control Module shall accept a regulated input voltage of 11.5VDC to 13.8VDC and generate appropriate voltage levels for on-board use as required. The input supply voltage shall be available to be bussed directly to the reader bus connectors to supply operating voltages for field readers. A jumper shall be provided for the ACP modules supporting direct Wiegand support to supply either 12VDC or 5 VDC to the external read heads.
4) Indicators: There shall be LEDs indicating the status of the received and transmitted data for the onboard communications ports, with active data turning on the LED. These LEDs shall be hardware controlled.
5) Ports: There shall be multiple ports provided on-board for external read heads, input/output boards. The number of actual ports varies according to the controller configuration.

C. System Enclosure: Sheet metal, of the appropriate gauge for the cabinet size per UL 294, shall be utilized. The cabinet shall be Black in color with a matte finish. The ACP's shall be housed in a locking 18 gauge metal cabinet, suitable for wall mounting. All cabinet locks shall be keyed alike. The cabinet shall be suitably sized to allow installation of the controller and all expansion modules and associated field wiring. The cabinet door shall include illuminated diagnostic indicators, which shall indicate the status of the panel. A single tamper switch shall be incorporated into the door. There shall be at least 4 mounting holes and 10 knockouts on the cabinet. Panel shall be provided with 120 volt power supply along with battery backup and battery charger.

2.4 CARD READERS

A. All readers shall be compatible with Owner's 26 bit, HID cards.

B. Readers shall be long range proximity, minimum 8" range, type technology system that complies with UL 294 standards and is certified as complying by Underwriters' Laboratories.

C. Manufacturer

1. Wall mount – HID SIGNO 40KTS-00-000000
2. Mullion Mount –HID SIGNO 20KTS-00-000000
3.

D. POWER SUPPLIES

1. Power supplies for mortise and/or strike lock power shall be suitable to provide 24vdc, 4 amp power.

E. Key Pad Units.

F. Electric Strikes.

G. Electric Locks.

H. Motion Dectectors.

I. Manual Stations.

J. System Cable.

PART 3 - EXECUTION

3.1 PRE-INSTALL MEETING

A. Prior to commencing installation, the trades shall convene for a coordination meeting including but not limited to the following parties:

1.
2. Architect
3. Electrical Engineer or Systems Designer
4. Construction Manager
5. Frame and Door Installer
6. Door Hardware Installer
7. Electrical and Fire Alarm contractor
8. Low voltage or security systems contractor
9.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use 16 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit.

C. Make conduit and wiring connections to door hardware devices furnished and installed under Division 08 Section "Door Hardware."

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 01 Section "Quality Control."

3.4 MANUFACTURER'S FIELD SERVICES

A. Include services of technician to supervise installation, adjustments, final connections, system testing, and to train Owner personnel.

3.5 DEMONSTRATION

A. Demonstrate normal and abnormal modes of operation, and required response to each.

B. Provide 2 hours of instruction each for two persons.

1. Conduct instruction at project site with manufacturer's representative.
2. Include travel and living expenses for Owner personnel.

END OF SECTION 28 1300

SECTION 28 1500 - ACCESS CONTROL HARDWARE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Card readers, credential cards, and keypads
2. Access control peripheral devices
3. Electrified locking devices and accessories
4. Lockdown controls and signals
5. Cables
6. Transformers

B. Related Requirements:

1.
2. Section 28 2000 “Video Surveillance” for integration with surveillance system.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Device layout information, including the following:
   a. Lockdown devices, including signal lights and initiation controls.
      1) Wiring diagrams indicating their connection to the access control system.
   b. Initial wiring diagrams and connections between all devices requiring relays to/from the access control system, including:
      1) Access control intercom
      2) Access control release buttons and toggle switches
      3) Lockdown systems
      4) Dialing and signaling requirements on lockdown events
2. Initial access control programming schedules for unlock/lock times.
3. Diagrams for cable management system.
4. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
5. Wall plate options: provide cutsheets of all wall plate types for signal controls.
6. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:

a. Workstation outlets, jacks, and jack assemblies.
b. Patch cords.
c. Patch panels.

7. Cable Administration Drawings: As specified in "Identification" Article.
8. Battery and charger calculations for central station, workstations, and controllers.

C. Product Schedules.

D. Samples: For workstation outlets, jacks, jack assemblies, and faceplates. For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Cable installer must have on staff an RCDD certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated

for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.

3. Indoor, Uncontrolled Environment: NEMA 250, Type 4 enclosures. System components installed in non-temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
4. Outdoor Environment: NEMA 250, NEMA 250, Type 4X enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 36 inches thick.
5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

PART 2 - PRODUCTS

2.1 OPERATION

A. Security access system hardware shall use a single database for access-control and credential-creation functions.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70, "National Electrical Code."

C. Comply with SIA DC-01 and SIA DC-03 and SIA DC-07.

2.3 CARD READERS, CREDENTIAL CARDS, AND KEYPADS

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

1. HID Global
   a. Card Readers
      1) HID Signo 20KTS, HID Signo 40KTS
      2) Equivalent substitutions are subject to Owner review prior to contract award. Equivalent substitutions must meet the following criteria:
         a) Weigand or OSDP protocol options
         b) Multi-technology read capability (125kHz and 13.56MHz minimum)
         c) Offer low-profile (mullion mounted) options
   b. Credentials
      1) Coordinate with owner prior to sign off to obtain access cards for programming into system.

B. Card Readers:

1. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.
2. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
3. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
   a. Indoors, controlled environment.
   b. Indoors, uncontrolled environment.
   c. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

4. Display: Digital visual indicator shall provide visible and audible status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
5. Stripe Swipe Readers: Bidirectional, reading cards swiped in both directions, powered by the controller. Reader shall be set up for ABA Track.
   a. Readers for outdoors shall be in a polymeric plastic enclosure with all electronics potted in plastic. Rated for operation in ambient conditions of minus 40 to plus 160 deg F in a humidity range of 10 to 90 percent.

6. Wiegand Swipe Reader: Set up for 33 or 26-bit data cards. Comply with SIA AC-01.
7. Touch-Plate and Proximity Readers:
   a. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
   b. Passive-detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
   c. The card reader shall read proximity cards in a range from direct contact to at least 6 inches from the reader.

2.4 ACCESS CONTROL PERIPHERAL DEVICES

1. Items listed below are basis of design
   a. Release Buttons & Switches
      1) Schlage
         a) 8204-MMMM-MS

2.5 CABLES

A. General Cable Requirements: Comply with requirements as recommended by system manufacturer for integration requirement.

B. PVC-Jacketed, TIA 232-F.

1. Nine, No. 22 AWG, stranded (7x30) tinned copper conductors.

2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated TIA 232-F Cables:

1. Nine, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

D. PVC-Jacketed, TIA 485-A Cables:

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. NFPA 70 Type: Type CM.
6. Flame Resistance: Comply with UL 1581.

E. Plenum-Rated TIA 485-A Cables:

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. NFPA 70 Type: Type CMP
6. Flame Resistance: NFPA 262, Flame Test.

F. Multiconductor, PVC, Reader and Wiegand Keypad Cables:

1. No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.
4. For TIA 232-F applications.

G. Paired, PVC, Toggle Switch Button Cables:

1. Four pairs, No. 18 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 18 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

H. Paired, PVC, Reader and Wiegand Keypad Cables:

1. Three pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

I. Paired, Plenum-Type, Reader and Wiegand Keypad Cables:

1. Three pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum-foil/polypropylene-tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

J. Multiconductor, Plenum-Type, Reader and Wiegand Keypad Cables:

1. Six conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

K. LAN Cabling:

1. Comply with requirements in Section 27 1513 "Communications Copper Horizontal Cabling."

2.6 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 SPECIAL REQUIREMENTS

A. At the exterior entry doors into common/shared space, ensure each card reader is connected to both Township Fire and Police systems.

3.2 INSTALLATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA 606-B, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Product Schedules: Obtain detailed product schedules from manufacturer of access-control system or develop product schedules to suit Project. Fill in all data available from Project plans and specifications and publish as Product Schedules for review and approval.

D. In meetings with Architect and Owner, present Product Schedules and review, adjust, and prepare final setup documents. Use approved, final Product Schedules to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

D. Install LAN cables using techniques, practices, and methods that are consistent with Category 5e rating of components and optical fiber rating of components, and that ensure Category 6 and optical fiber performance of completed and linked signal paths, end to end.

E. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

F. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

A. Comply with TIA 569-D, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling: Install at a maximum distance of 50 ft. between terminations.

D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. between terminations.

E. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft., and install No. 20 AWG wire if maximum distance is 500 ft..
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 500 ft. between terminations.

G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft. between terminations.

3.5 GROUNDING

A. Comply with Section 27 0526 "Grounding and Bonding for Communications Systems."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
2. Bus: Mount on wall of main equipment room with standoff insulators.
3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 IDENTIFICATION

A. In addition to requirements in this article, comply with TIA 606-B.

3.7 SYSTEM SOFTWARE AND HARDWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use tester approved for type and kind of installed cable. Test for faulty connectors, splices, and terminations. Test according to TIA 568-C.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for balanced twisted-pair cables must comply with minimum criteria in TIA 568-C.1.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery

power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.

1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

END OF SECTION 28 1500

SECTION 28 2000 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a video surveillance system consisting of cameras, data transmission wiring and associated equipment.

1.2 ACTION SUBMITTALS

A. Provide product data sheets with specific part numbers highlighted.

B. IP Based Cameras.

C. Camera Mounting Accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Camera Aiming Documentation.

1. Create a spreadsheet with the following columns and submit during submittal process. Camera name (on drawings), camera name (as directed by owner), Camera Make/Model, MAC address, IP Address, View, Camera Image, Status, Comments, and Sign Off. Leave all fields blank except for Camera Name (drawings) and camera Make/Model. Camera Name (drawings) and camera make/model shall be completed as part of submittal.
    a. Camera name (drawings): Device number provided by architect
    b. Camera name (owner): Device name provided by owner
    c. Camera make and model.
    d. MAC address
    e. IP address: as provided by owner
    f. View: what the view is aiming to achieve Status: camera status at time of document iteration
    g. Comments: Any additional aiming that needs to be completed.
    h. Sign Off: for architect and owner to sign off each camera as complete.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, accessories, method of field assembly, components, and location and size of each field connection.
2. Show cable types and sizes.
3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
4. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. As-Built Drawings.

1. Provide electronic (minimum .pdf) copy of as built conditions of cameras, mounts, their cable's port, rack, and closet number, and aiming views (along with a screenshot of view at time of completion).

B. Operation and Maintenance Data.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
3. Interior, Uncontrolled Environment: System components installed in non- temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 24 inches thick. Use NEMA 250, Type 3S enclosures.
5. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Video Management System and cameras as installed and programmed *must* meet the requirements set forth in LARA Rule 27, including (but not limited to):

1. Clear and certain identification of person(s), including facial features and activities, of all recorded areas
2. Any area where marihuana products are weighed, packed, stored, loaded, unloaded for transportation, prepared, or moved within the facility.
3. Limited access areas and security rooms
4. Transfers of product and secured items between rooms
5. Entrances and exits of the facility, from both interior and exterior vantage points.
6. 24/7 continuous recording with timestamps on each view
7. 14 days minimum recorded video storage
8. Alarms and notification system for camera comm failure, network outage, tamper, or any other failure or disruption of the VMS and its server(s).
9. Logs of any activity including the removal, destruction, and/or modification of recordings or recording equipment.

B. Resolution of cameras shall meet LARA Rule 27 requirements above, achieving minimum 40 px/ft “clearly identify and recognize”.

C. Video-signal format shall comply with NTSC standard, at a minimum resolution of 720p.

D. Surge Protection: Protect components from voltage surges entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

E. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NECA 1.

D. Comply with NFPA 70.

E. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

2.3 IP BASED CAMERAS

A. Basis of Design – refer to drawings for camera type requirement at each location.

1. Camera Types
   a. Type A (C101 on drawings)
      1) 5mp fixed dome camera
         a) Built-in IR
         b) IK10, IP66
         c) PoE powered
         d)
   b. Type B (C103 on drawings)
      1) 5mp fixed dome camera
         a) Built-in IR
         b) IK10, IP52
         c) PoE powered
         d)
         e)

2. Recommended Manufacturers:
   a. Axis Communications
      1) P Series
         a) 3267

3. Substitutions: Requests for submissions shall be made prior to submittal and only at the acceptance of the owner.

B. Description:

1. Cameras shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. Cameras shall be powered over ethernet (PoE) and where data cable distance or model type requires, be supported by PoE injectors and/or power assist methods.
3. Cameras shall meet the following standards:
   a. Interior: IP52, IK10, FCC Class A, CE, Vandal resistant
   b. Exterior: IP66, IK10, FCC Class A, CE, Vandal resistant
4. Camera models shall be installed at their intended locations and all necessary supporting equipment, including brackets, mounts, and housings, shall be provided.
5. System shall have seamless integration of all video surveillance and control functions.
6. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
7. System design shall include all necessary compression software for high-performance (H.264 or better), dual-stream, MPEG-4 video or better, and transmission via unicast or multicast. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
8. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
9. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.

2.4 All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.

2.5 CAMERA-SUPPORTING EQUIPMENT

1. Provide supporting equipment to install a complete system, including but not limited to:
   a. Pendant mounts
   b. Wall mounts
   c. Corner mounting brackets
   d. NPT/threaded adapters
   e. Caulk/sealant as necessary

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment. Include all necessary components for specified devices.

2.6 NETWORK VIDEO RECORDERS

A. Requirements

1. Camera(s) shall be added to the existing NVR system.

B. Recommended Manufacturers

1. Axis Communications

2.7 LICENSING

A. Provide licensing as required per camera and/or per server.

PART 3 - EXECUTION

3.1 WIRING

A. For communication wiring, comply with the following:

1. Section 27 1513 "Communications Copper Horizontal Cabling."

B. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.2 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Cameras, NVR, and all supporting equipment must be installed by an installer with manufacturer-specific training, including but not limited to Axis Certified Professional designation.

B. Cameras and NVRs shall be installed to be separate and independent of each other.

C. Install cameras with 24-inchminimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

D. Prior to install, the following process must be completed:

1. Default camera username and password configured to owner-provided standard.
2. Obtain submittal document from Architect with “Views” column completed.
3. Provide document to Owner and Architect with MAC addresses filled out

E. Prior to installation, set views according to returned submittal document. The following items shall be completed prior to project closeout:

1. Verify final views with owner while installing. If owner or architect cannot be reached, obtain a digital image and send to owner and architect for review of final positioning.
2. Connect all controls and alarms and adjust.
3. Obtain owner/architect sign off on spreadsheet.

F. Confirm power and data connectivity on device and network side; for devices that do not have sufficient power or full data transmission, provide PoE+ injector.

G. Identify system components, wiring, cabling, and terminals.

1. Labeling: Label each camera housing with the corresponding device number on prints as well as closet number and port of data drop associated to camera. Labeling shall be visible without removing the camera housing.

H. Obtain sign off of camera views from primary representative of each system – Township and Police – as well as the technology consultant.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
   a. Verify operation of auto-iris lenses.
   b. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.

c. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
d. Set and name all preset positions; consult Owner's personnel.
e. Set sensitivity of motion detection.
f. Connect and verify responses to alarms.
g. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation.

C. Video surveillance system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 28 2000

Kalamazoo Public Schools
Every child, every opportunity, every time!

MAPLE STREET MAGNET SCHOOL FOR THE ARTS OFFICE RENOVATION

KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

CONSTRUCTION DOCUMENTS

DESIGN TEAM

ARCHITECT/ENGINEER

TowerPinkster
Architecture · Engineering · Interiors

242 E. KALAMAZOO AVE, SUITE 100
KALAMAZOO, MICHIGAN 49007
PHONE: 269.343.6133
FAX: 269.343.6633

SKILLMAN

8120 MOORSBRIDGE RD, SUITE 101
PORTAGE, MICHIGAN 49024
PHONE: 269.350.5757

SITE ADDRESS

KALAMAZOO PUBLIC SCHOOLS
922 W MAPLE ST
KALAMAZOO, MI 49008

REFERENCED CODES

BUILDING:	2021 MICHIGAN BUILDING CODE AND 2012 NFPA 101 LIFE SAFETY CODE
BUILDING:	2021 MICHIGAN REHABILITATION CODE FOR EXISTING BUILDINGS
ENERGY:	2021 MICHIGAN ENERGY CODE
PLUMBING:	2021MICHIGAN PLUMBING CODE
MECHANICAL:	2021 MICHIGAN MECHANICAL CODE
FUEL GAS:	(IFGC) 2021 INTERNATIONAL FUEL GAS CODE
ELECTRICAL:	2023 NATIONAL ELECTRICAL CODE WITH MICHIGAN AMENDMENTS
BARRIER-FREE:	2021 MICHIGAN BUILDING CODE AND 2017 ICC & C A117.1
USE GROUP:	E
CONSTRUCTION TYPE:	2B
AUTOMATIC SPRINKLERS:	NO

PROJECT AREA

TOTAL LEVEL 1 ALTERATION AREA:	3,477 SQ. FT
TOTAL LEVEL 2 ALTERATION AREA:	36 SQ. FT
TOTAL LEVEL 3 ALTERATION AREA:	2,125 SQ. FT
TOTAL ADDITION AREA:	1,029 SQ. FT
TOTAL UNMODIFIED BUILDING AREA:	129,739 SQ. FT
TOTAL BUILDING AREA:	136,406 SQ. FT

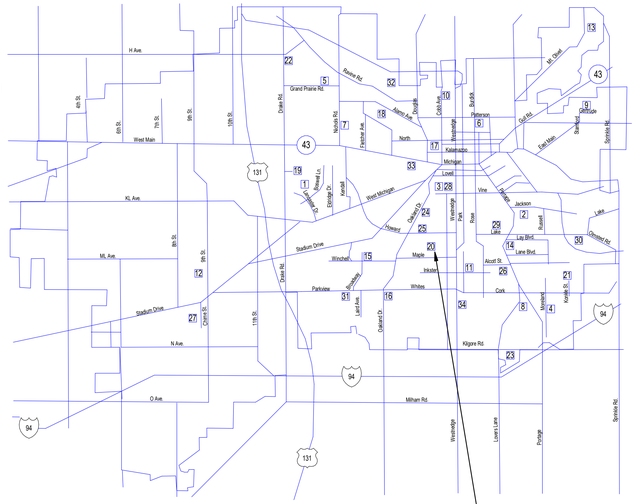
DISTRICT MAP

Elementary Schools
1. Arcadia
2. Edison Academy
3. El Sol
4. Greenwood
5. Indian Prairie
6. Lincoln International Studies School
7. Martin Luther King in Westwood
8. Milwood
9. Northeastern
10. Northglade Montessori Magnet School
11. Parkwood-Upjohn
12. Prairie Ridge
13. Spring Valley Center for Exploration
14. Washington Writers' Academy
15. Winchell
16. Woods Lake : A Magnet Center for the Arts
17. Woodward School

Middle Schools
18. Hillside
19. Linden Grove
20. Maple Street Magnet School for the Arts
21. Milwood Magnet School: A Center for Math, Science, and Technology

High Schools
22. Kalamazoo Central
23. Loy Norrix
24. Phoenix

Facilities and Programs
25. Administration Building
26. Alcott Street Stockroom
27. District Kitchen
28. Community Education Center
29. Lake Street Barns
30. Lakewood
31. Oakwood
32. Transportation
33. West Main School
34. South Westnedge School



KALAMAZOO PUBLIC SCHOOLS DISTRICT MAP
SCALE: NONE

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Add. No. 1 — Feb. 9, 2026
ISSUED FOR — DATE

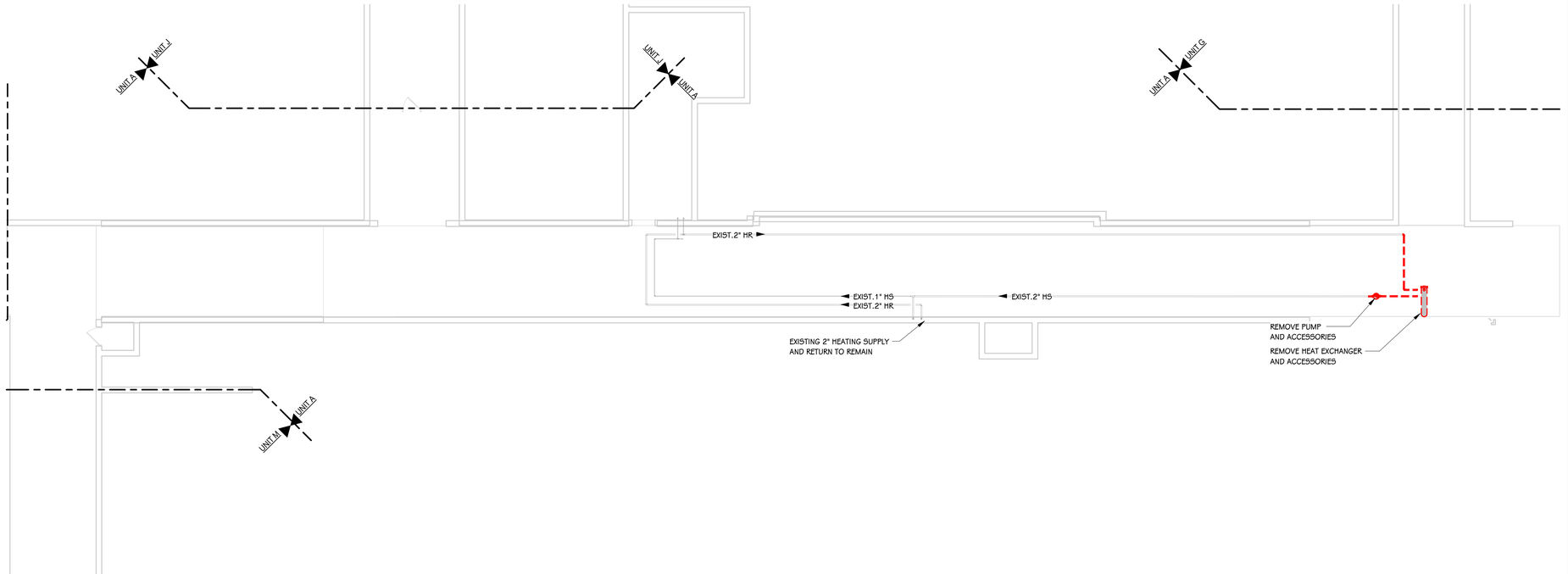
PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS OFFICE RENOVATION

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

DATE
DECEMBER 8, 2025

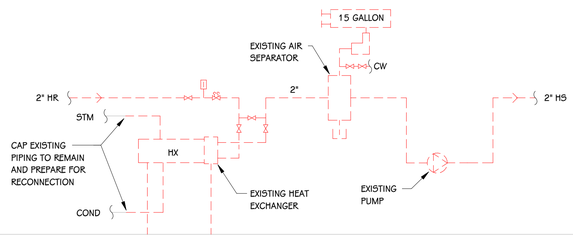
SHEET TITLE
COVER SHEET

SHEET NUMBER
G 001
23626.00



TUNNEL MECHANICAL DEMOLITION PLAN - UNIT A

3/32" = 1'-0"



HEAT EXCHANGER DEMOLITION PIPING SCHEMATIC

SCALE: NONE

KEYED NOTES - MECHANICAL - DEMOLITION

1 REMOVE PTAC UNIT COMPLETE.

2 REMOVE WALL MOUNTED FINNED TUBE AND PIPING BACK TO MAIN AND CAP.

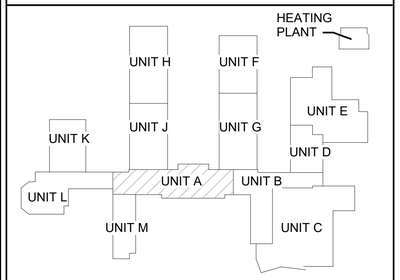
3 REMOVE WINDOW TYPE AC UNIT.

4 REMOVE CABINET HEATER AND PIPING BACK TO MAIN AND CAP.

5 REMOVE HEATING WATER PIPING. WHERE EXISTING PIPING IS TO REMAIN, CAP AND PREPARE TO FOR RECONNECTION.

THIS DRAWING SHEET IS INTENDED TO BE PLOTTED IN COLOR. IF THIS TEXT APPEARS IN BLACK AND WHITE, IT IS PLOTTED INCORRECTLY. DISCARD AND OBTAIN AN ACCURATE DRAWING

MAPLE STREET



KEY PLAN

SCALE: NO SCALE

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ADDENDUM #1	02-09-2026
ISSUED FOR	DATE

PROJECT TITLE
MAPLE STREET MAGNET
SCHOOL FOR THE ARTS

OWNER
KALAMAZOO PUBLIC
SCHOOLS

KALAMAZOO, MICHIGAN

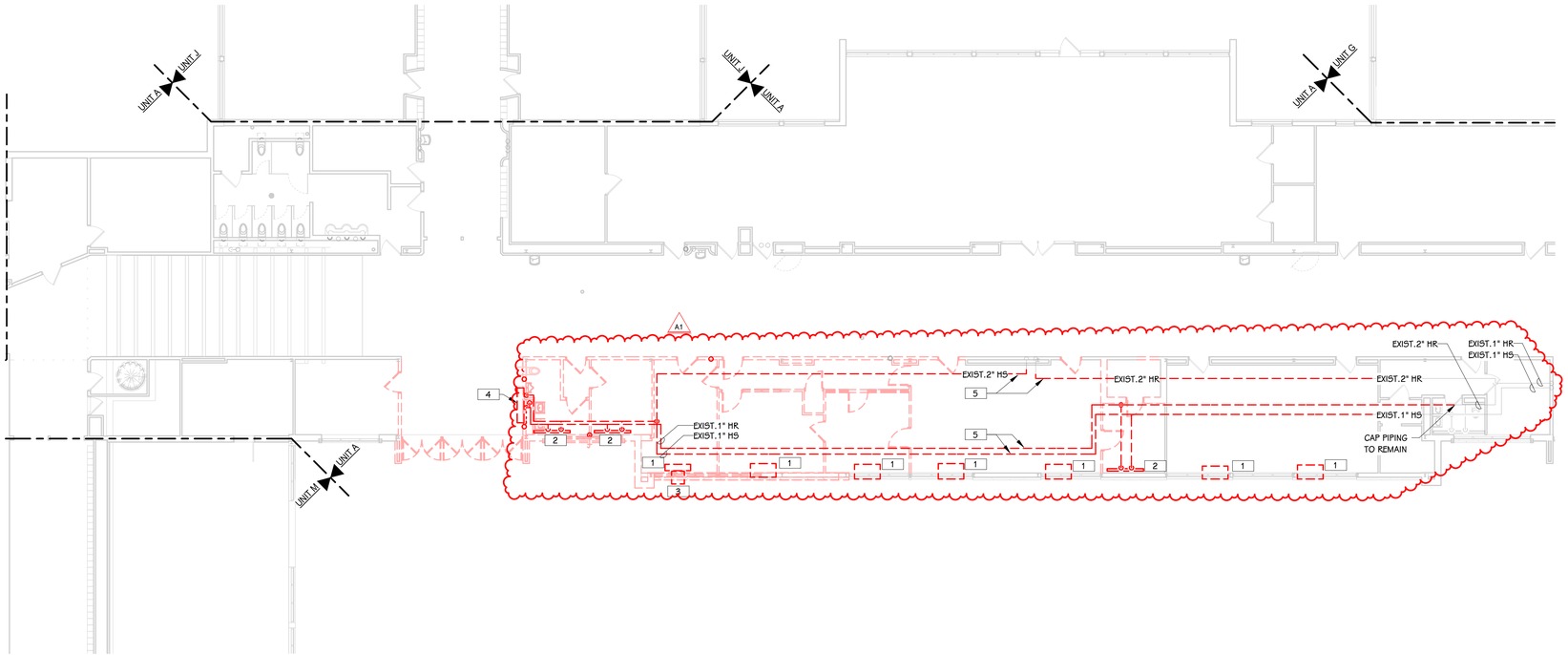
DATE
DECEMBER 8, 2025

SHEET TITLE
TUNNEL MECHANICAL DEMOLITION
PLAN - UNIT A

SHEET NUMBER
MD 001A

A1

23-626.00



FIRST FLOOR MECHANICAL DEMOLITION PLAN - UNIT A
3/32" = 1'-0"

KEYED NOTES - MECHANICAL - DEMOLITION

1 REMOVE PTAC UNIT COMPLETE.

2 REMOVE WALL MOUNTED FINNED TUBE AND PIPING BACK TO MAIN AND CAP.

3 REMOVE WINDOW TYPE AC UNIT.

4 REMOVE CABINET HEATER AND PIPING BACK TO MAIN AND CAP.

5 REMOVE HEATING WATER PIPING. WHERE EXISTING PIPING IS TO REMAIN, CAP AND PREPARE TO FOR RECONNECTION.

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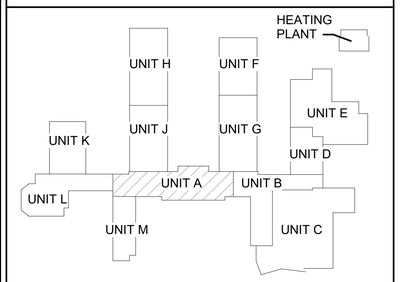
MAPLE STREET



KEY PLAN
SCALE: NO SCALE

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ADDENDUM #1 02-09-2026

ISSUED FOR DATE

PROJECT TITLE
MAPLE STREET MAGNET
SCHOOL FOR THE ARTS

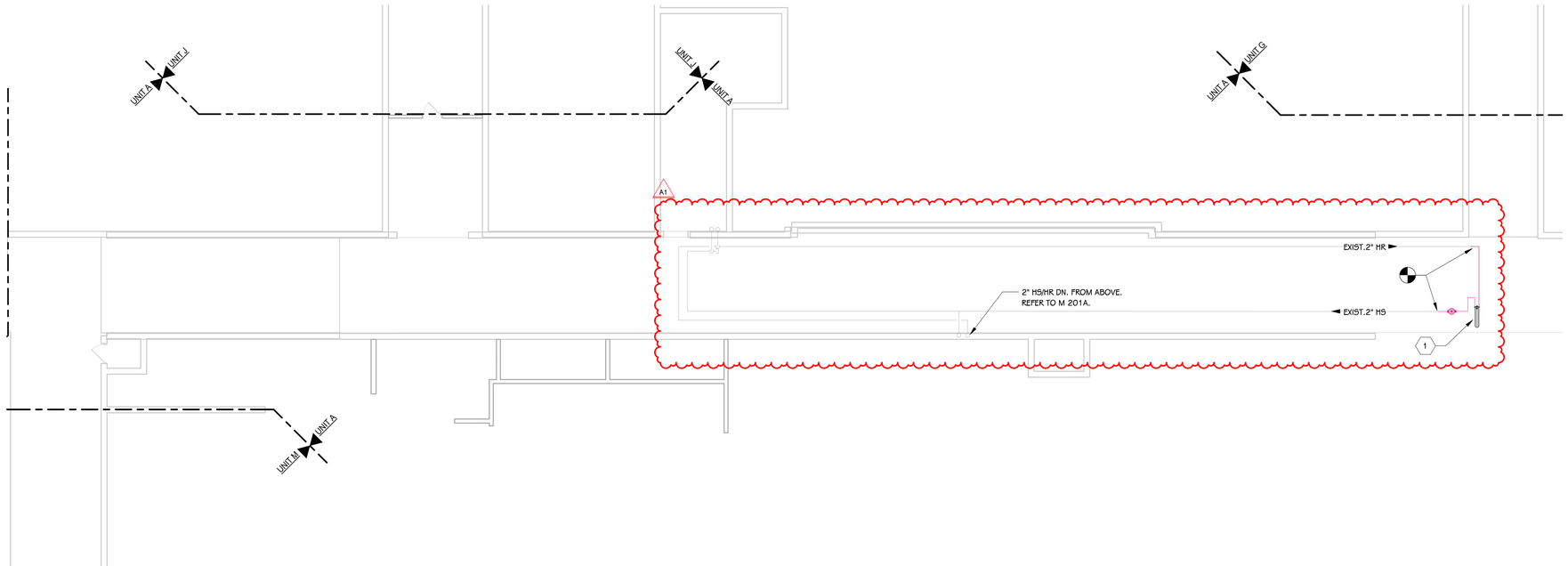
OWNER
KALAMAZOO PUBLIC
SCHOOLS

KALAMAZOO, MICHIGAN

SHEET TITLE
FIRST FLOOR MECHANICAL DEMOLITION
PLAN - UNIT A

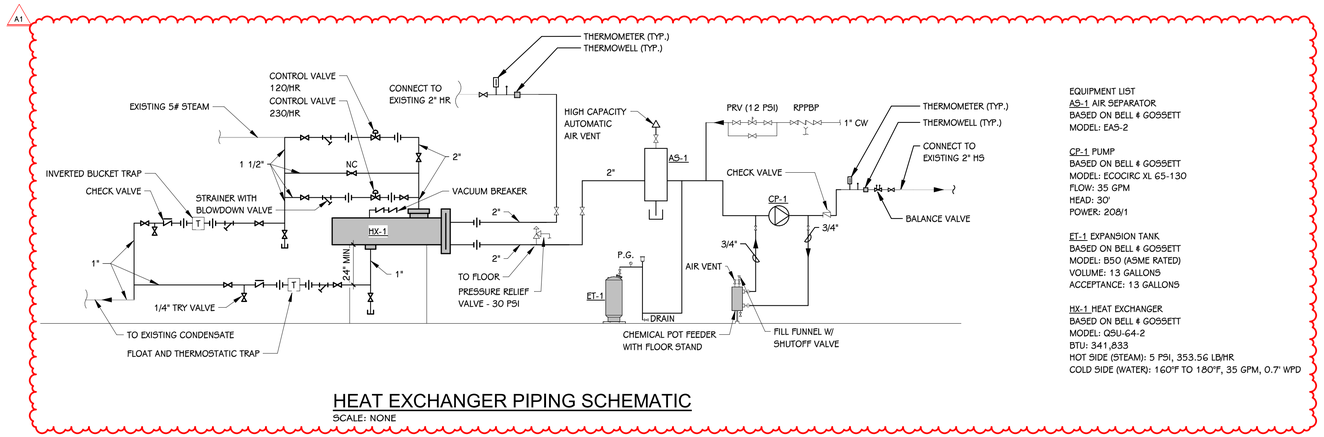
DATE
DECEMBER 8, 2025

SHEET NUMBER
MD 101A
23-626.00



TUNNEL HVAC PIPING PLAN - UNIT A

3/32" = 1'-0"



EQUIPMENT LIST

AS-1 AIR SEPARATOR
BASED ON BELL & GOSSETT
MODEL: EAS-2

CP-1 PUMP
BASED ON BELL & GOSSETT
MODEL: ECOCIRC XL 65-130
FLOW: 35 GPM
HEAD: 30'
POWER: 208/1

ET-1 EXPANSION TANK
BASED ON BELL & GOSSETT
MODEL: B50 (ASME RATED)
VOLUME: 13 GALLONS
ACCEPTANCE: 13 GALLONS

HX-1 HEAT EXCHANGER
BASED ON BELL & GOSSETT
MODEL: G5U-G4-2
BTU: 341,833
HOT SIDE (STEAM): 5 PSI, 353.56 LB/HR
COLD SIDE (WATER): 160°F TO 180°F, 35 GPM, 0.7' WPD

HEAT EXCHANGER PIPING SCHEMATIC

SCALE: NONE

KEYED NOTES - MECHANICAL - HVAC PIPING

A1

1 REFER TO HEAT EXCHANGER PIPING SCHEMATIC FOR PIPNG DETAILS.

2 1 1/2" H5 & HR DROP TO TUNNEL PLAN. ROUTE PIPING THROUGH EMPTY CHA5E FROM REMOVED DUCTWORK.

3 3/4" H5 & HR CONNECTION TO REHEAT COIL.

4 1" H5 & HR CONNECTION TO REHEAT COIL.

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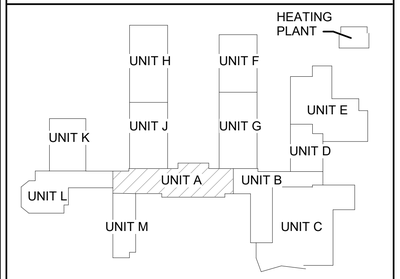
MAPLE STREET



KEY PLAN

SCALE: NO SCALE

TowerPinkster
Architecture · Engineering · Interiors
ANN ARBOR, MICHIGAN

ADDENDUM #1 02-09-2026

ISSUED FOR DATE

PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS

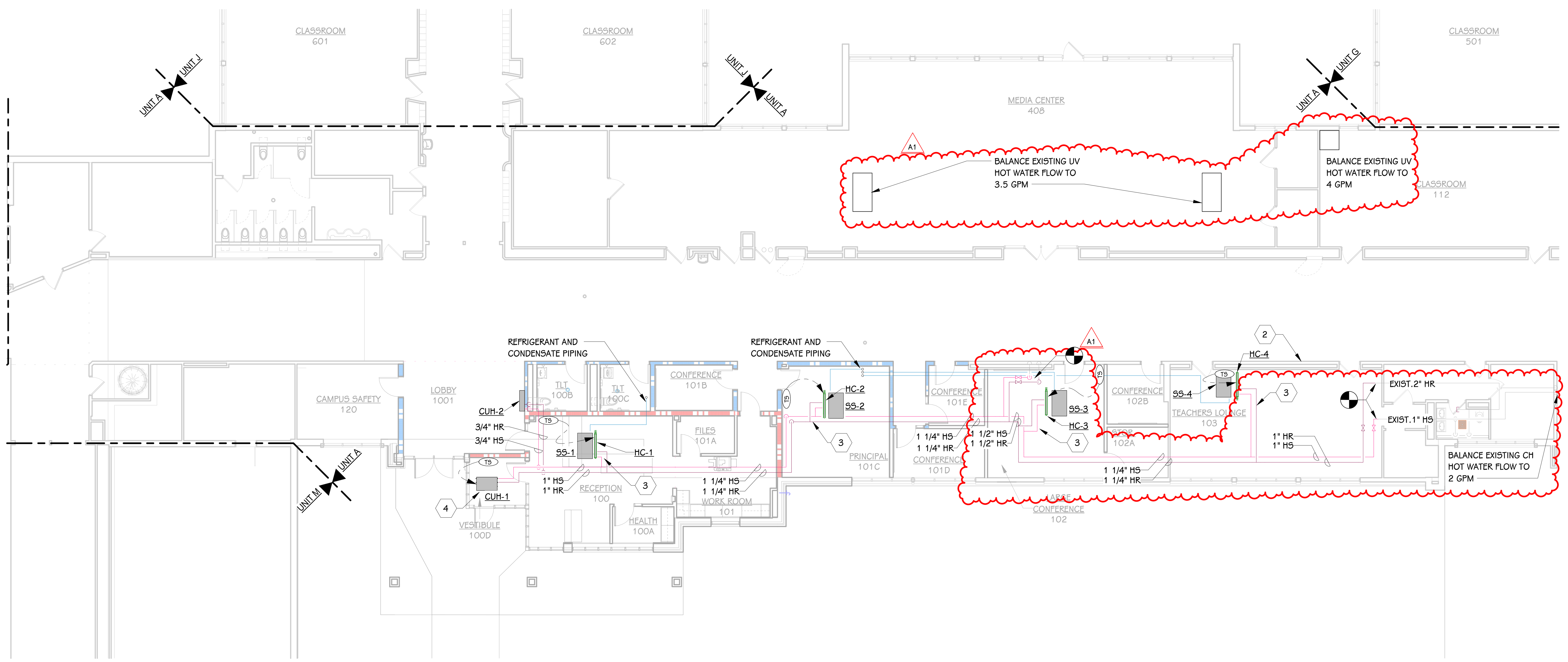
OWNER
KALAMAZOO PUBLIC SCHOOLS

KALAMAZOO, MICHIGAN

SHEET TITLE
TUNNEL HVAC PIPING PLAN - UNIT A

DATE
DECEMBER 8, 2025

SHEET NUMBER
M 200A
23-626.00



FIRST FLOOR HVAC PIPING PLAN - UNIT A

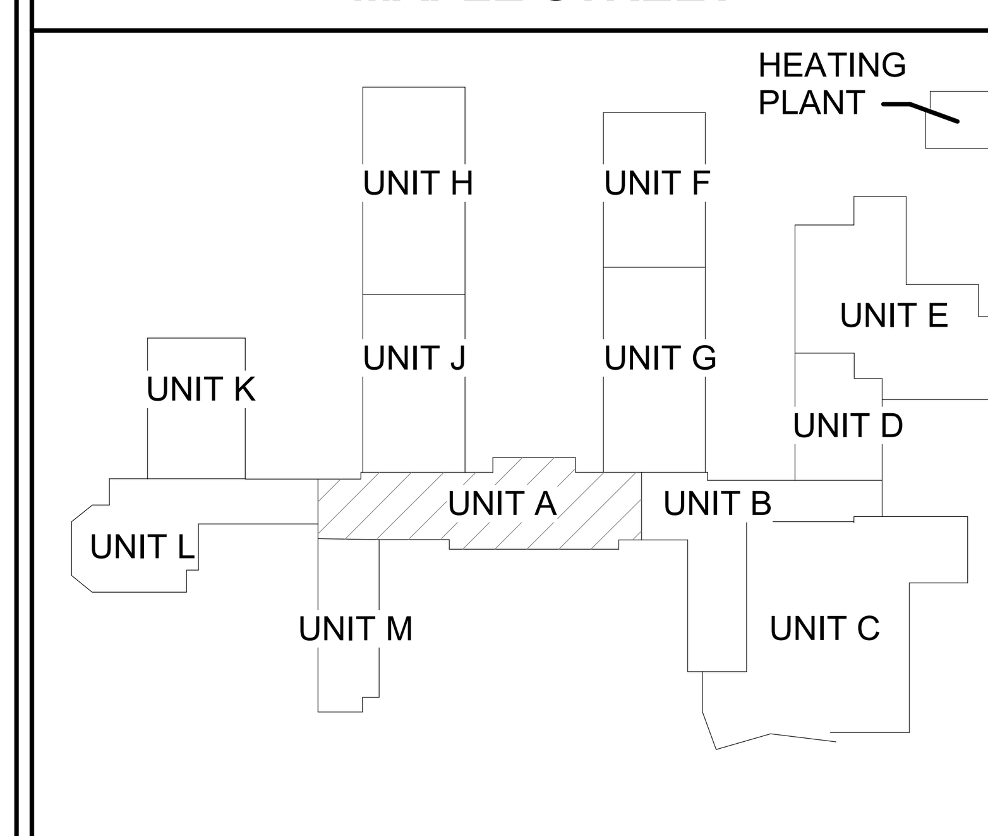
3/32" = 1'-0"

KEYED NOTES - MECHANICAL - HVAC PIPING

1. REFER TO HEAT EXCHANGER PIPING SCHEMATIC FOR PIPNG DETAILS.
2. 1 1/2" HS & HR DROP TO TUNNEL PLAN. ROUTE PIPING THROUGH EMPTY CHASE FROM REMOVED DUCTWORK.
3. 3/4" HS & HR CONNECTION TO REHEAT COIL.
4. 1" HS & HR CONNECTION TO REHEAT COIL.

THIS DRAWING SHEET IS INTENDED TO BE PLOTTED IN COLOR. IF THIS TEXT APPEARS IN BLACK AND WHITE, IT IS PLOTTED INCORRECTLY. DISCARD AND OBTAIN AN ACCURATE DRAWING

MAPLE STREET



KEY PLAN

SCALE: NO SCALE

TowerPinkster
Architecture · Engineering · Interiors

ISSUED FOR	DATE
ADDENDUM #1	02-09-2026

PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS

OWNER
KALAMAZOO PUBLIC SCHOOLS
KALAMAZOO, MICHIGAN

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FIRST FLOOR HVAC PIPING PLAN - UNIT A

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EXHAUST FANS — BASED ON GREENHECK

MARK	MODEL	TYPE	AIR FLOW (CFM)	ESP (IN WC)	SONES	HP	RPM	VOLTAGE	PHASE	REMARKS
EF-1	G-080-E	ROOF, CENTRIFUGAL	200	0.5	7.4	1/6	1,517	120	1	PROVIDE WITH 14 INCH HIGH ROOF CURB
EF-2	G-080-E	ROOF, CENTRIFUGAL	200	0.5	7.4	1/6	1,517	120	1	PROVIDE WITH 14 INCH HIGH ROOF CURB
EF-3	CSP-A125	DIRECT DRIVE CABINET	100	0.2	<0.3	22W	923	120	1	

CABINET HEATERS - WATER — BASED ON RITTLING

MARK	MODEL	TYPE	AIRFLOW (CFM)	HEATING COIL					MOTOR DATA			CONTROL VALVE	REMARKS
				CAPACITY (MBH)	FLOW (GPM)	WPD (FT)	EWT (°F)	LWT (°F)	HP	VOLTAGE	PHASE		
CUH-1	RCW-420-04	CEILING RECESSED	310	19.5	2.0	1.20	140 °F	120 °F	1/25	120	1	3-WAY	
CUH-2	RCW-420-04	WALL SURFACE	420	23.1	2.0	1.20	140 °F	117 °F	1/25	120	1	3-WAY	

GRILLES, REGISTERS, & DIFFUSERS — BASED ON PRICE

MARK	PANEL SIZE	FACE SIZE	NECK SIZE	MODEL	CFM RANGE	VCD	THROW	MATERIAL	FINISH	INSTALLATION	REMARKS
SA-1	24x24	-	6" Ø	A5CDA	120-200	NO		ALUMINUM	WHITE	LAY-IN	
SA-2	24x24	-	8" Ø	A5CDA	175-315	NO		ALUMINUM	WHITE	LAY-IN	
SA-3	24x24	-	10" Ø	A5CDA	210-490	NO		ALUMINUM	WHITE	LAY-IN	
SA-4	12x12	-	6" Ø	A5CDA	75-125	NO	5-10-20	ALUMINUM	WHITE	SURFACE	
RA-1	24"x24"	-	22"x22"	80	500 - 2000	NO	-	ALUMINUM	WHITE	LAY-IN	
TA-1	24"x24"	-	22"x22"	80	500 - 2000	NO	-	ALUMINUM	WHITE	LAY-IN	
EA-1	12"x12"	-	12"x12"	80	0-500	NO	-	ALUMINUM	WHITE	SURFACE	

HEATING COILS - HOT WATER — BASED ON USA COIL & AIR

MARK	SIZE	ROWS	CFM	TMBH	E.A.T. (°F)	L.A.T. (°F)	GPM	E.W.T. (°F)	A.P.D. (IN WC)	MAX W.P.D. (FT)	AIR VELOCITY (FPM)	CONTROL VALVE	REMARKS
HC-1	7.5" X 44"	2	700	29.1	52.0	90.4	3.0	140 °F	0.07	5.00	310	A1 2-WAY	
HC-2	7.5" X 44"	2	475	17.8	56.0	90.7	1.8	140 °F	0.03	5.00	210	2-WAY	
HC-3	9" X 44"	2	900	43.9	46.0	91.1	4.4	140 °F	0.09	5.00	330	2-WAY	
HC-4	9" X 44"	2	900	33.2	56.0	90.0	3.4	140 °F	0.08	5.00	330	2-WAY	

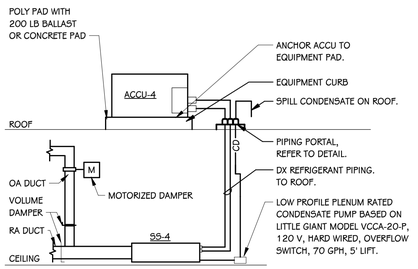
OUTDOOR AIR INTAKE / RELIEF HOODS — BASED ON GREENHECK

MARK	MODEL	THROAT SIZE	CURB HEIGHT	AIR FLOW (CFM)	MAX APD (IN WC)	CONTROL DAMPER	REMARKS
IH-1	GRSI-8	8"	1' - 6"	150	0.10	REFER TO CONTROLS	
IH-2	GRSI-16	16"	1' - 6"	490	0.10	REFER TO CONTROLS	

ELECTRIC UNIT HEATERS — BASED ON QMARK

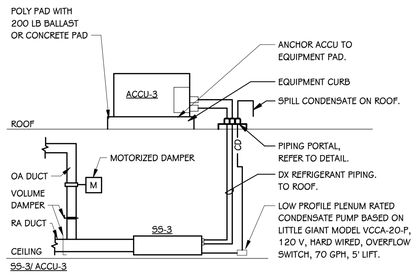
MARK	MODEL	AIRFLOW (CFM)	KW	HEATING COIL	ELECTRICAL DATA			REMARKS
				CAPACITY (MBH)	HP	VOLTAGE	PHASE	
EUH-1	MUH-07	650	7.5	25.6	1/30	208	3	1

1. PROVIDE WITH 2-STAGE CAPACITY CONTROL.



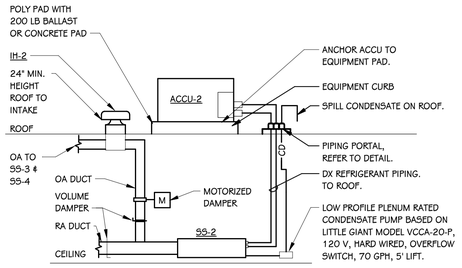
SS-4/ ACCU-4
BASED ON SAMSUNG
INDOOR MODEL: AC030DNHDCG/AA
OUTDOOR MODEL: AC030DX5CCG/AA
NOMINAL COOLING: 30MBH, NOMINAL HEATING: 35 MBH
SEER2: 20, EER2: 13, POWER: 208/1 WITH INDOOR UNIT POWERED FROM
OUTDOOR UNIT, 900 CFM, 150 OA CFM, BI-POLAR IONIZATION
FLOOR

SPLIT SYSTEM UNIT PIPING DETAIL - CEILING UNIT 4
SCALE: NONE



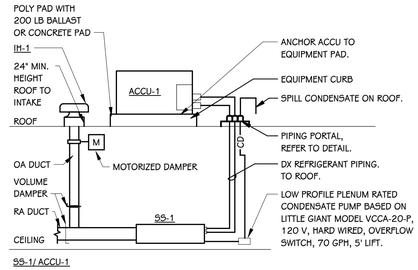
SS-3/ ACCU-3
BASED ON SAMSUNG
INDOOR MODEL: AC030DNHDCG/AA
OUTDOOR MODEL: AC030DX5CCG/AA
NOMINAL COOLING: 30 MBH, NOMINAL HEATING: 35 MBH
SEER2: 20, EER2: 13, POWER: 208/1 WITH INDOOR UNIT POWERED
FROM OUTDOOR UNIT, 900 CFM, 260 OA CFM, BI-POLAR IONIZATION
FLOOR

SPLIT SYSTEM UNIT PIPING DETAIL - CEILING UNIT 3
SCALE: NONE



SS-2/ ACCU-2
BASED ON SAMSUNG
INDOOR MODEL: AC012DNHDCG/AA
OUTDOOR MODEL: AC012DX5CCG/AA
NOMINAL COOLING: 12 MBH, NOMINAL HEATING: 14 MBH
SEER2: 18.6, EER2: 11.7, POWER: 208/1 WITH INDOOR UNIT POWERED
FROM OUTDOOR UNIT, 475 CFM, 80 OA CFM, BI-POLAR IONIZATION
FLOOR

SPLIT SYSTEM UNIT PIPING DETAIL - CEILING UNIT 2
SCALE: NONE



SS-1/ ACCU-1
BASED ON SAMSUNG
INDOOR MODEL: AC0324DNHDCG/AA
OUTDOOR MODEL: AC024DX5CCG/AA
NOMINAL COOLING: 23 MBH, NOMINAL HEATING: 27 MBH
SEER2: 18, EER2: 12, POWER: 208/1 WITH INDOOR UNIT POWERED FROM OUTDOOR
UNIT, 700 CFM, 150 OA CFM, BI-POLAR IONIZATION
FLOOR

SPLIT SYSTEM UNIT PIPING DETAIL - CEILING UNIT 1
SCALE: NONE

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ADDENDUM #1 02-09-2026
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MAPLE STREET MAGNET
SCHOOL FOR THE ARTS

OWNER
KALAMAZOO PUBLIC
SCHOOLS

KALAMAZOO, MICHIGAN

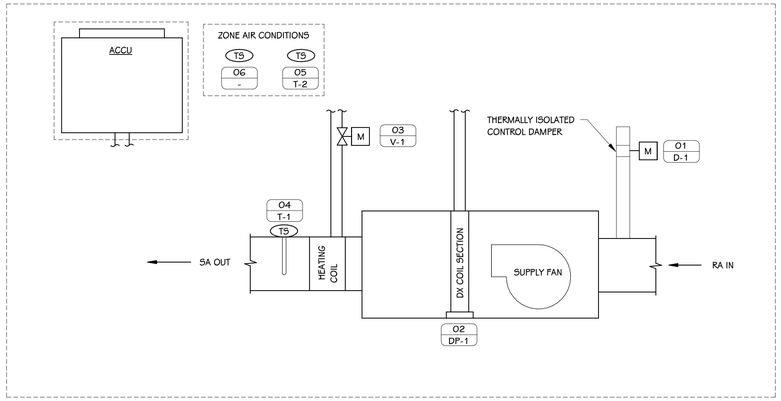
SHEET TITLE
MECHANICAL SCHEDULES AND DETAILS

DATE
DECEMBER 8, 2025

SHEET NUMBER
M 501
23-626.00

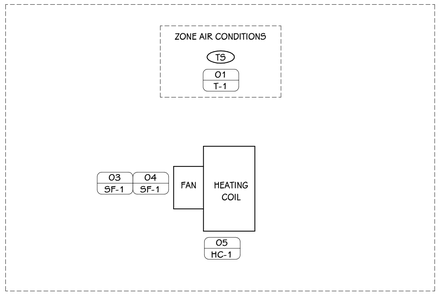
CONTROL POINTS

NUMBER	TAG	DESCRIPTION	ALARM	TREND	REMARKS
CEILING EXHAUST FAN CONTROL POINTS					
01	EF-1	FAN ENABLE/DISABLE		■	
02	EF-1	FAN STATUS	■	■	
03	OS-1	OCCUPANCY SENSOR		■	
FAN COIL					
01	D-1	OUTDOOR AIR DAMPER POSITION		■	
02	DP-1	DRAIN PAN ALARM	■		
03	V-1	HEATING CONTROL VALVE POSITION		■	
04	T-1	DISCHARGE AIR TEMPERATURE		■	
05	T-2	ZONE AIR TEMPERATURE		■	
06	-	ZONE CONTROLLER			
ROOF MOUNTED EXHAUST FAN CONTROL POINTS					
01	D-1	EXHAUST AIR DAMPER POSITION		■	OPEN/CLOSE
02	EF-1	FAN ENABLE/DISABLE		■	
03	EF-1	FAN STATUS	■	■	
CABINET UNIT HEATERS					
01	T-1	ZONE AIR TEMPERATURE		■	
02	T-2	DISCHARGE AIR TEMPERATURE		■	
03	SF-1	FAN STATUS	■	■	
04	SF-1	ENABLE/DISABLE		■	
05	V-1	CONTROL VALVE POSITION		■	
ELECTRIC UNIT HEATERS					
01	T-1	ZONE AIR TEMPERATURE		■	
03	SF-1	FAN STATUS	■	■	
04	SF-1	ENABLE/DISABLE		■	
05	HC-1	ENABLE/DISABLE		■	



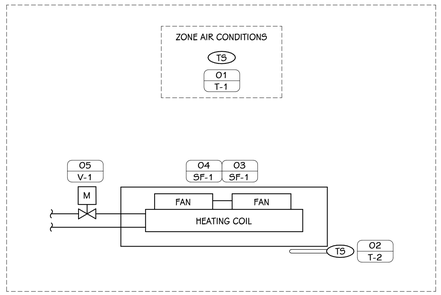
FAN COIL CONTROLS DIAGRAM

SCALE: NONE



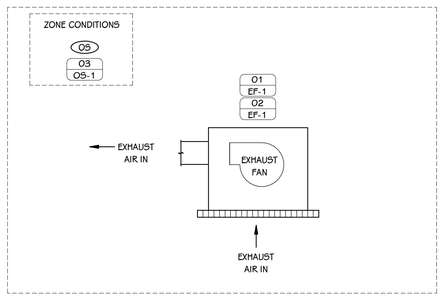
ELECTRIC UNIT HEATER (EUH) CONTROLS DIAGRAM

SCALE: NONE



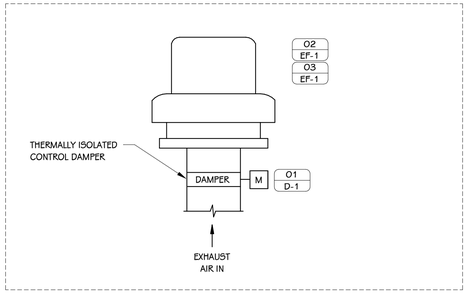
HHWS (CUH) CONTROLS DIAGRAM

SCALE: NONE



EXHAUST FAN (FF) CONTROLS DIAGRAM

SCALE: NONE



EXHAUST FAN (ROOF) CONTROLS DIAGRAM

SCALE: NONE

SEQUENCE OF OPERATIONS

NOTE: ALL LABOR, MATERIAL, EQUIPMENT AND SOFTWARE NOT SPECIFICALLY INDICATED WITHIN CONTROLS DRAWINGS THAT IS REQUIRED TO MEET THE FUNCTIONAL INTENT OF THE SEQUENCE OF OPERATIONS SHALL BE PROVIDED WITHOUT ADDITIONAL COST. POINT LISTS SHALL BE A GUIDE TO THE POINTS REQUIRED FOR CONTROL SYSTEM. FINAL POINTS SHALL BE DETERMINED BY SEQUENCE OF OPERATIONS. ALL SET POINTS SHALL BE OPERATOR ADJUSTABLE THROUGH THE BMS. ALL POINTS SHALL BE TRENDABLE.

FAN COIL

1. UNIT WILL HAVE FACTORY PROVIDED CONTROL OF HEAT PUMP OPERATION AND WILL PROVIDE A CONTACT TO ENABLE HOT WATER HEATING. PROVIDE FIELD INSTALLED CONTROLS FOR THE FOLLOWING ITEMS: HEATING HOT WATER COIL, CONTROL VALVE (CV) WITH ACTUATOR, DRAIN PAN SENSOR, AIR TEMPERATURE SENSORS, AND OUTDOOR AIR DAMPER.
2. FAN COIL UNIT ADJUSTABLE SCHEDULE BASED ON THE FOLLOWING:
   A. TIME OF DAY (TOD) SCHEDULE.
      a. TO BE DETERMINED BY OWNER (CONSULT WITH OWNER).
3. FAN COIL UNIT ADJUSTABLE SETPOINTS:
   A. HEATING AND COOLING SETPOINTS SHALL MAINTAIN A MINIMUM OFFSET OF 5°F.
   B. OCCUPIED 72°F COOLING / 70°F HEATING
   C. STANDBY 77°F COOLING / 68°F HEATING (BASED ON LIGHTING OCCUPANCY SENSOR(S))
   D. UNOCCUPIED 85°F COOLING / 62°F HEATING
4. START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN INDEXED TO STOP:
      a. HEATING CV SHALL MODULATE TO MAINTAIN MIXED/DISCHARGE AIR TEMPERATURE SENSOR AT 60°F (ADJ.), WHEN OUTDOOR AIR TEMPERATURE IS BELOW 45°F (ADJ.).
      b. OUTDOOR AIR DAMPER CLOSED.
   B. WHEN INDEXED TO START:
      a. OPEN OUTDOOR AIR DAMPER.
5. COOLING/HEATING: FACTORY CONTROLLER SHALL CYCLE DX TO MAINTAIN SPACE TEMPERATURE SETPOINT.
6. AUXILIARY HEATING: MODULATE THE HEATING COIL NORMALLY OPEN CONTROL VALVE TO MAINTAIN HEATING SETPOINT.
7. DRAIN PAN MONITORING - SYSTEM CONTROLLER SHALL MONITOR AND ALARM FOR HIGH-WATER LEVEL.
   A. COOLING SHALL BE DISABLED UPON DETECTION OF HIGH-WATER LEVEL.
8. UNOCCUPIED CONTROL - SYSTEM CONTROLLER SHALL INITIATE THE FOLLOWING BASED ON A FALL OR RISE IN SPACE TEMPERATURE:
   A. HEATING AND COOLING CONTROL WILL BE THE SAME AS OCCUPIED CONTROL.
   B. THE UNIT SHALL ENERGIZE AND PROVIDE HEATING AND COOLING BASED ON THE SPACE TEMPERATURE SENSORS TO BRING SPACE TO UNOCCUPIED SETPOINT. THE OUTDOOR AIR DAMPER SHALL BE CLOSED.
9. OPTIMUM START - SYSTEM CONTROLLER SHALL ENABLE UNIT PRIOR TO SCHEDULED OCCUPANCY UTILIZING OPTIMUM START LOGIC TO ADJUST STARTUP TIME FOR UNIT BASED ON OUTDOOR AIR TEMPERATURE, BUILDING TEMPERATURE AND HISTORIC ELAPSE TIME TO REACH SETPOINT. OUTDOOR AIR DAMPER SHALL BE CLOSED DURING MORNING WARM UP.

EXHAUST FAN CONTROLS

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR SYSTEM OPERATION. SYSTEM IS A COMBINATION OF CONSTANT VOLUME EXHAUST FAN AND ISOLATION DAMPER.
2. OPERATION SHALL BE BASED ON:
   A. TIME OF DAY SCHEDULE.
      a. TO BE DETERMINED BY OWNER (CONSULT WITH OWNER).
3. SYSTEM START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN INDEXED TO STOP:
      a. DISABLE EXHAUST FAN.
      b. ISOLATION AIR DAMPER 100% CLOSED.
   B. WHEN INDEXED TO START:
      a. ENABLE EXHAUST FAN.
      b. ISOLATION AIR DAMPER 100% OPENED.
4. SYSTEM DDC MONITORING AND ALARMING OF THE FOLLOWING:
   A. EXHAUST FAN MOTOR STATUS.
      a. WHEN ENABLED, AND AFTER A DELAY OF TWO (2) MINUTES (ADJ.) WITH NO STATUS SENSED, THE DDC SHALL INDICATE A GENERAL ALARM.
      b. WHEN ENABLED AND STATUS IS SENSED BY THE CURRENT SENSOR, A RUN TIMER WILL BE ACTIVE.

CABINET UNIT HEATER (CUH)

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR CABINET HEATER OPERATION. CABINET HEATER IS A COMBINATION OF A CONSTANT VOLUME FAN, FILTER, HEATING COIL, CONTROL VALVE (CV) WITH ACTUATOR, AND AIR TEMPERATURE SENSOR.
2. CABINET HEATER ADJUSTABLE SETPOINT:
   A. SPACE TEMPERATURE SETPOINT SHALL BE 60°F (MAXIMUM).
3. OPERATION SHALL BE BASED ON THE FOLLOWING:
   A. OPERATION BASED ON WALL MOUNTED THERMOSTAT THAT WILL ENABLE UNIT WHENEVER SPACE TEMPERATURE FALLS BELOW HEATING SETPOINT.
4. START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN INDEXED TO STOP:
      a. DISABLE FAN.
      b. HEATING CV 100% CLOSED.
   B. WHEN INDEXED TO START:
      a. HEATING CV 100% OPENED.
      b. ENABLE FAN.
   C. WHEN OUTDOOR AIR TEMPERATURE IS GREATER THAN 45°F, UNIT SHALL BE DISABLED.
5. MONITORING AND ALARMING OF THE FOLLOWING:
   A. FAN MOTOR STATUS.
      a. WHEN ENABLED, AND AFTER A DELAY OF TWO (2) MINUTES (ADJ.) WITH NO STATUS SENSED, THE DDC SHALL INDICATE A GENERAL ALARM.
      b. WHEN ENABLED AND STATUS IS SENSED BY THE CURRENT SENSOR, A RUN TIMER WILL BE ACTIVE.

SEQUENCE OF OPERATIONS (CONT'D)

UNIT HEATER

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR UNIT HEATER OPERATION. UNIT HEATER IS A COMBINATION OF A CONSTANT VOLUME FAN, ELECTRIC HEATING COIL, AND AIR TEMPERATURE SENSOR.
2. UNIT HEATER ADJUSTABLE SCHEDULE BASED ON THE FOLLOWING:
   A. SCHEDULED WITH MAIN BUILDING SCHEDULE.
3. UNIT HEATER ADJUSTABLE SETPOINT:
   A. SPACE TEMPERATURE SETPOINT SHALL BE 60°F (MAXIMUM).
4. OPERATION SHALL BE BASED ON THE FOLLOWING:
   A. OPERATION BASED ON WALL MOUNTED THERMOSTAT THAT WILL ENABLE UNIT WHENEVER SPACE TEMPERATURE FALLS BELOW HEATING SETPOINT.
5. START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN INDEXED TO STOP:
      a. DISABLE FAN.
      b. DISABLE HEATING COIL.
   B. WHEN INDEXED TO START:
      a. ENABLE FAN.
      b. ENABLE HEATING COIL.
6. MONITORING AND ALARMING OF THE FOLLOWING:
   A. FAN MOTOR STATUS.
      a. WHEN ENABLED, AND AFTER A DELAY OF TWO (2) MINUTES (ADJ.) WITH NO STATUS SENSED, THE DDC SHALL INDICATE A GENERAL ALARM.
      b. WHEN ENABLED AND STATUS IS SENSED BY THE CURRENT SENSOR, A RUN TIMER WILL BE ACTIVE.

SEQUENCE OF OPERATIONS GENERAL CONDITIONS

A. BMS CONTRACTOR TO SUBMIT DETAILED STEP-BY-STEP CONTROL SEQUENCES. COPYING THESE SEQUENCES INTO THE SUBMITTALS IS NOT ACCEPTABLE.
B. ALL INITIAL ADJUSTABLE RANGES AND SETPOINT VALUES SHALL BE INDICATED. GRAPHIC CONTROL LOGIC FLOW CHARTS FOR EACH CONTROL SYSTEM SHALL BE INCLUDED TO SUPPORT SEQUENCES.
C. ALL SETPOINTS AND PARAMETERS SHALL BE ADJUSTED OR MODIFIED AS REQUIRED DURING SUBMITTAL REVIEW, SETUP AND COMMISSIONING AT NO EXTRA COST.
D. THE DIRECT DIGITAL CONTROLS (DDC) SHALL BE PROGRAMMED TO THE SEQUENCE OF OPERATION AS DESCRIBED WITHIN THE CONTRACT DOCUMENTS. PROVIDE AND INSTALL ALL NECESSARY COMPONENTS AND ACCESSORIES FOR A COMPLETE AND OPERATIONAL SYSTEM INCLUDING, BUT NOT LIMITED TO SENSORS, RELAYS, GATEWAYS, WIRING, CONDUIT, AND ALL NECESSARY ELECTRICAL DEVICES.
E. ALL SETPOINTS, DEAD BANDS, AND TIME DELAY INTERVALS DESCRIBED IN THE SEQUENCE SHALL BE ADJUSTABLE BY SYSTEM OPERATORS. APPROPRIATE DEAD BANDS AND TIME DELAYS SHALL BE USED TO PREVENT SHORT CYCLING ON OTHERWISE PROTECT EQUIPMENT.
F. ALL VARIABLE FREQUENCY CONTROLLERS AND STARTER HAND-OFF-AUTO SWITCHES NORMALLY REMAIN IN THE AUTO POSITION AND THE HAND AND OFF POSITIONS ARE USED FOR MAINTENANCE SITUATIONS.
G. THE BUILDING MANAGEMENT SYSTEM WILL MONITOR, AND CONTROL SYSTEMS AS NOTED BELOW UNLESS OTHERWISE NOTED.
H. PROVIDE FINAL CALIBRATION K-FACTORS FOR ALL DEVICES INCLUDING, BUT NOT LIMITED TO TERMINAL AIR UNITS, AIRFLOW STATIONS, FAN OFFSETS.
I. DDC AND BMS ARE USED INTERCHANGEABLY IN THE CONTRACT DOCUMENTS.
J. ALL LABOR, MATERIAL, EQUIPMENT AND SOFTWARE NOT SPECIFICALLY INDICATED WITHIN CONTROLS DRAWINGS OR SPECIFICATIONS THAT ARE REQUIRED TO MEET THE FUNCTIONAL INTENT OF THE SEQUENCE OF OPERATIONS SHALL BE PROVIDED WITHOUT ADDITIONAL COST. POINT LISTS SHALL BE A GUIDE TO THE POINTS REQUIRED FOR THE CONTROL SYSTEM. FINAL POINTS SHALL BE DETERMINED BY SEQUENCE OF OPERATIONS. ALL SET POINTS SHALL BE OPERATOR ADJUSTABLE THROUGH THE BMS. ALL POINTS SHALL BE TRENDED.

HEAT EXCHANGER AND PUMP

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR HEAT EXCHANGER AND PUMP OPERATION. SYSTEM IS A COMBINATION OF A VARIABLE SPEED PUMP (ECM), STEAM CONTROL VALVES, AND WATER TEMPERATURE SENSORS.
2. ENABLE SYSTEM
   A. FOR OUTDOOR AIR TEMPERATURE BELOW 65°F (ADJ).
   B. UPON A CALL FOR HEAT FROM EQUIPMENT SERVED.
3. OPERATION SHALL BE BASED ON THE FOLLOWING:
   A. MODULATE PUMP TO MAINTAIN SYSTEM DIFERENTIAL PRESSURE. INITAL SETPOINT SHALL BE DETERMINED BY TAB CONTRACTOR.
   B. MODULATE 1/3 - 2/3 STEAM CONTROL VALVES TO MAINTAIN HOW WATER SET POINT.
      a. RESET HOT WATER SUPPLY TEMPERATURE BASED ON OUTDOOR AIR TEMPERATURE. PROVIDE A STRAIGHT LINE RESET BETWEEN THE FOLLOWING POINTS.
         • FOR OUTDOOR AIR TEMPERATURE OF 65°F (ADJ): 110°F (ADJ)
         • FOR OUTDOOR AIR TEMPERATURE OF 10°F (ADJ): 180°F (ADJ)
4. MONITOR AND ALARM
   A. SUPPLY WATER TEMPERATURE
   B. RETURN WATER TEMPERATURE
   C. SYSTEM STATUS
   D. PUMP MODULATION
   E. ALARM PUMP FAILURE
   F. ALRAM FOR WATER TEMPERATURE 10°F (ADJ) BELOW SETPOINT

A1

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ADDENDUM #1 02-09-2026

ISSUED FOR DATE

PROJECT TITLE
MAPLE STREET MAGNET
SCHOOL FOR THE ARTS

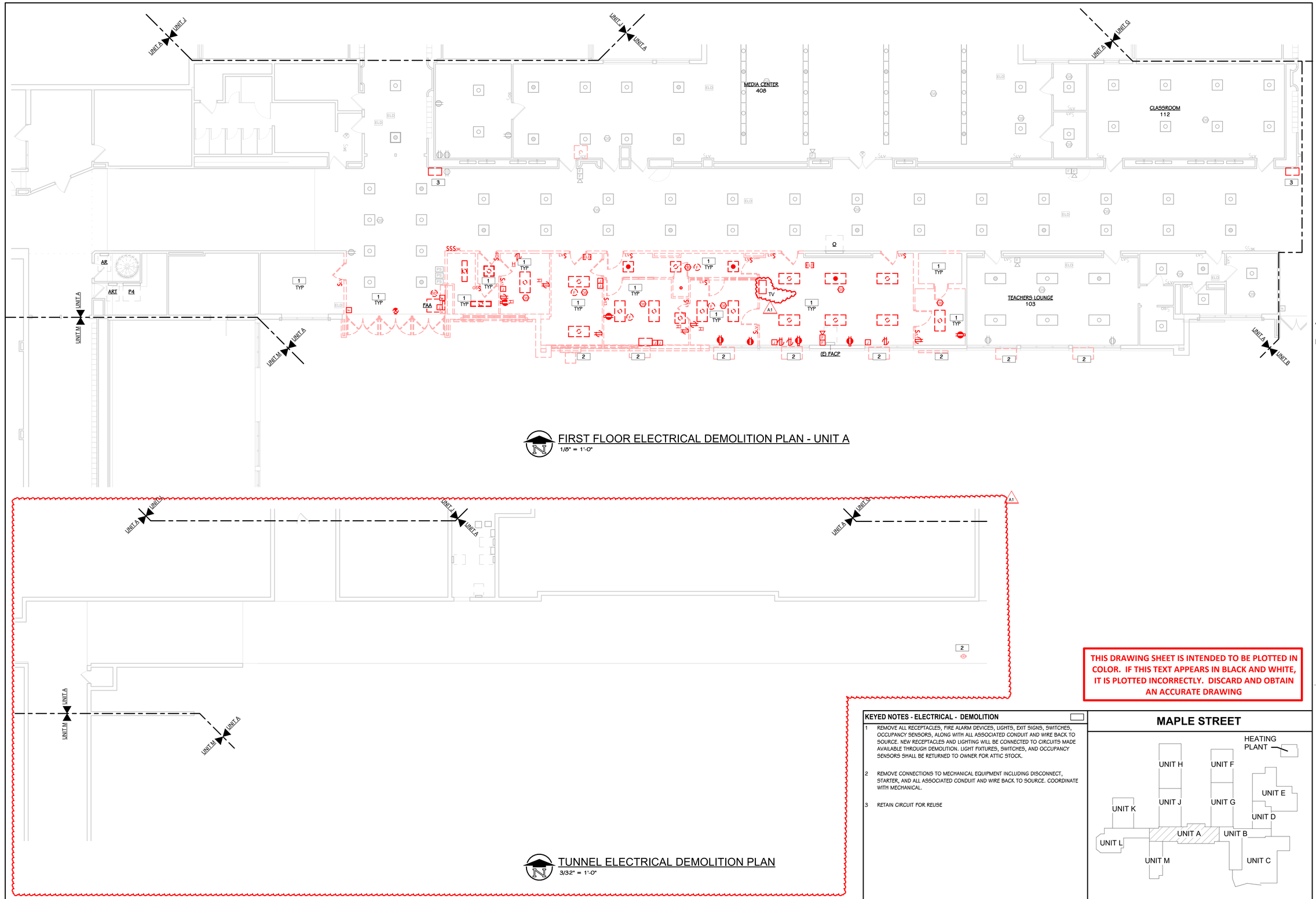
OWNER
KALAMAZOO PUBLIC
SCHOOLS

KALAMAZOO, MICHIGAN

SHEET TITLE
MECHANICAL CONTROLS

DATE
DECEMBER 8, 2025

SHEET NUMBER
M 601
23-626.00



FIRST FLOOR ELECTRICAL DEMOLITION PLAN - UNIT A

1/8" = 1'-0"

TUNNEL ELECTRICAL DEMOLITION PLAN

3/32" = 1'-0"

THIS DRAWING SHEET IS INTENDED TO BE PLOTTED IN COLOR. IF THIS TEXT APPEARS IN BLACK AND WHITE, IT IS PLOTTED INCORRECTLY. DISCARD AND OBTAIN AN ACCURATE DRAWING

KEYED NOTES - ELECTRICAL - DEMOLITION

1 REMOVE ALL RECEPTACLES, FIRE ALARM DEVICES, LIGHTS, EXIT SIGNS, SWITCHES, OCCUPANCY SENSORS, ALONG WITH ALL ASSOCIATED CONDUIT AND WIRE BACK TO SOURCE. NEW RECEPTACLES AND LIGHTING WILL BE CONNECTED TO CIRCUITS MADE AVAILABLE THROUGH DEMOLITION. LIGHT FIXTURES, SWITCHES, AND OCCUPANCY SENSORS SHALL BE RETURNED TO OWNER FOR ATTIC STOCK.

2 REMOVE CONNECTIONS TO MECHANICAL EQUIPMENT INCLUDING DISCONNECT, STARTER, AND ALL ASSOCIATED CONDUIT AND WIRE BACK TO SOURCE. COORDINATE WITH MECHANICAL.

3 RETAIN CIRCUIT FOR REUSE

MAPLE STREET

KEY PLAN

SCALE: NO SCALE

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ADDENDUM #1	02-09-2026
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PROJECT TITLE
MAPLE STREET MAGNET
SCHOOL FOR THE ARTS
OFFICE RENOTATION -
SECURE VESTIBULE &
OFFICE

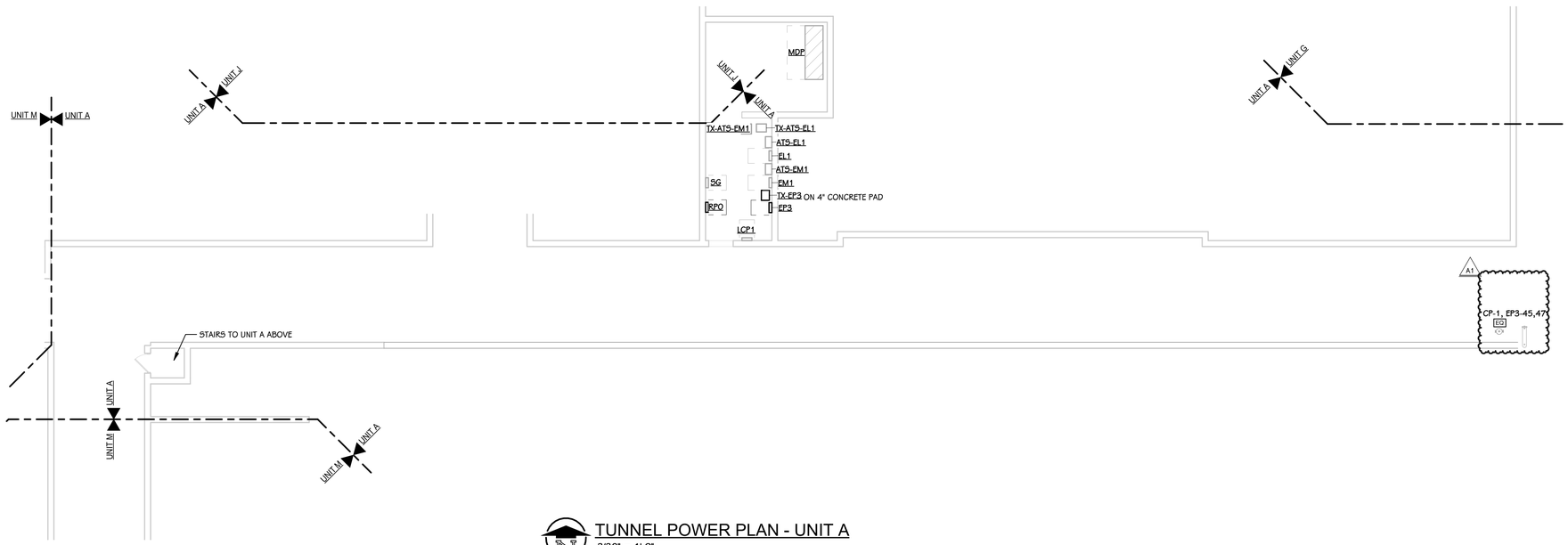
OWNER
KALAMAZOO PUBLIC
SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
FIRST FLOOR ELECTRICAL DEMOLITION
PLAN - UNIT A

DATE
DECEMBER 8, 2025

SHEET NUMBER
ED 101A
23-626.00



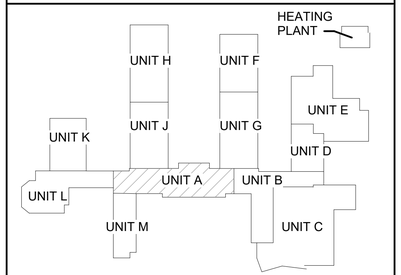
TUNNEL POWER PLAN - UNIT A

3/32" = 1'-0"

KEYED NOTES - ELECTRICAL - POWER

1. PROVIDE AND SIZE FUSES PER MANUFACTURER'S RECOMMENDED MOCP.
2. CONNECT TO EXISTING CIRCUIT REMAINING FROM DEMOLITION.
3. OUTDOOR UNIT WILL SUPPLY POWER TO INDOOR UNIT, REFER TO DETAIL.
4. SCAN SLAB WITH GROUND PENETRATING RADAR (GPR) AND SAW CUT / FLOOR CORE PRIOR TO INSTALLATION. COORDINATE FINAL LOCATION WITH DIMENSIONED FURNITURE PLANS PRIOR TO SAW CUTTING FLOOR OR INSTALLING FLOOR BOX. ROUTE POWER AND DATA CONDUITS TO AV, REFER TO TECHNOLOGY DETAILS.
5. PROVIDE HARDWIRED CONNECTION TO FAN COIL UNIT CONDENSATE PUMP. COORDINATE LOCATION IN FIELD WITH MECHANICAL CONTRACTOR.
6. ROUTE CONDUITS THROUGH MILLWORK, COORDINATE WITH CARPENTER.

MAPLE STREET



KEY PLAN

SCALE: NO SCALE

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OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

SHEET TITLE
TUNNEL POWER PLAN - UNIT A

DATE
DECEMBER 8, 2025

SHEET NUMBER
E100A
23-626.00

ELECTRICAL TRANSFORMER SCHEDULE

TRANSFORMER NAME	FED FROM	SIZE	PRIMARY VOLTAGE (V)	BREAKER / POLES	TRANSFORMER G.E.C.	PRIMARY FEEDER # OF SET(S)	PRIMARY FEEDER WIRE	PRIMARY FEEDER GROUND	PRIMARY FEEDER EMT	SECONDARY FEEDER LOAD NAME	SECONDARY OCP	SECONDARY FEEDER # OF SETS	SECONDARY FEEDER WIRE	SECONDARY FEEDER GROUND	SECONDARY FEEDER EMT
TX-EP3	EM1	30 kVA	480 V	45 A / 3	1 #6	1 SET	3 #6	#8 G.E.C.	1"	EP3	100 A	1 SET	4 #1	#6 G.E.C.	2"

ELECTRICAL PANEL FEEDER SCHEDULE

DESCRIPTION	FED FROM	CURRENT (FLA)	DEMAND (FLA)	BREAKER / POLES	FEEDER # OF SETS	FEEDER WIRE	FEEDER GROUND	FEEDER EMT	ACCUM VOLT DROP %	NOTES
208 V										
EP3	TX-EP3	53 A	45 A	100 A / 3	1 SET	4 #1	#8 GND.	2"	0.2%	
RP0	MDP	47 A	47 A	400 A / 3	1 SET	4 #600 KCMIL	#3 GND.	4"	0.3%	

ELECTRICAL HVAC FEEDER SCHEDULE

DESCRIPTION	FED FROM	DISCONNECT MEANS	CURRENT (FLA)	DEMAND (FLA)	BREAKER/POLES	FEEDER # OF SETS	FEEDER WIRE	FEEDER GROUND	FEEDER EMT	ACCUM VOLT DROP %	NOTES
208 V											
HVAC - EUH-1	K	FACTORY	21 A	21 A	30 A/3	1 SET	4 #10	#10 GND.	3/4"	3.8%	
208 V											
HVAC - ACCU-1	RP0	NEMA 3R 30A FDS	19 A	19 A	30 A/2	1 SET	3 #10	#10 GND.	3/4"	2.5%	
HVAC - ACCU-2	RP0	NEMA 3R 30A FDS	5 A	5 A	15 A/2	1 SET	3 #12	#10 GND.	3/4"	1.2%	
HVAC - ACCU-3	RP0	NEMA 3R 30A FDS	26 A	26 A	40 A/2	1 SET	3 #8	#10 GND.	3/4"	2.2%	
HVAC - ACCU-4	RP0	NEMA 3R 30A FDS	26 A	26 A	40 A/2	1 SET	3 #8	#10 GND.	3/4"	2.4%	
HVAC - CP-1	EP3	STARTER DISC	8 A	8 A	15 A/2	1 SET	3 #12	#12 GND.	3/4"	3.0%	
120 V											
HVAC - CP-1	RP0	NEMA 3R NFDS	3 A	3 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	1.8%	
HVAC - CUH-1	EP3	FACTORY	6 A	6 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	2.8%	
HVAC - CUH-2	EP3	FACTORY	10 A	10 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	4.9%	
HVAC - EF-1	EP3	NEMA 3R NFDS	2 A	2 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	0.9%	
HVAC - EF-2	K	NEMA 3R NFDS	2 A	2 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	2.7%	
HVAC - EF-3	EP3	NEMA 3R NFDS	2 A	2 A	20 A/1	1 SET	2 #12	#12 GND.	3/4"	1.1%	

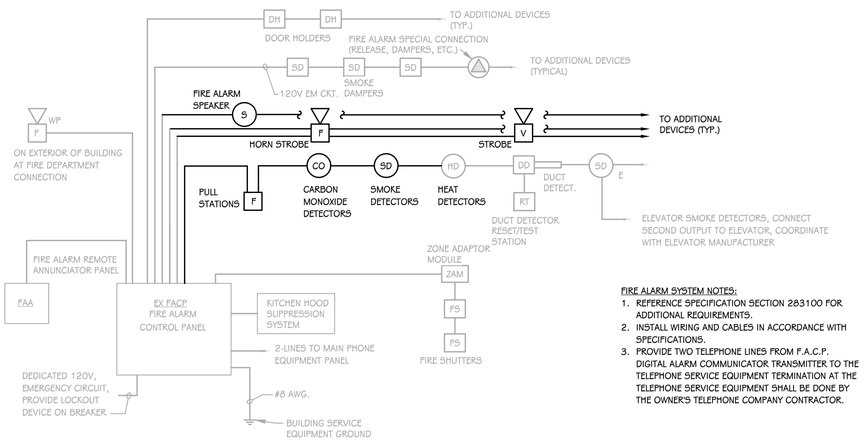
A1

ELECTRICAL PANEL AND HVAC FEEDER SCHEDULE NOTES:

1 CONDUIT SIZES BASED ON EMT AND COPPER CONDUCTORS (UNLESS OTHERWISE INDICATED WITH AN "AL" FOR ALUMINUM). UPSIZE AS REQUIRED WHERE PVC OR GALVANIZED IS USED OR REQUIRED PER SPECIFICATIONS.

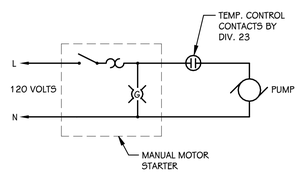
2 G.E.C. = GROUNDING ELECTRODE CONDUCTOR FOR SEPARATELY DERIVED SYSTEM (PER SET, USE EQUIVALENT CMIL AND GEC FROM 250.66)

3 GND. = EQUIPMENT GROUNDING CONDUCTOR (E.G.C.)

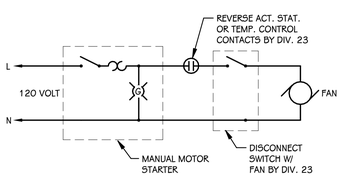


FIRE ALARM SYSTEM NOTES:
1. REFERENCE SPECIFICATION SECTION 283100 FOR ADDITIONAL REQUIREMENTS.
2. INSTALL WIRING AND CABLES IN ACCORDANCE WITH SPECIFICATIONS.
3. PROVIDE TWO TELEPHONE LINES FROM F.A.C.P. DIGITAL ALARM COMMUNICATOR TRANSMITTER TO THE TELEPHONE SERVICE EQUIPMENT TERMINATION AT THE TELEPHONE SERVICE EQUIPMENT SHALL BE DONE BY THE OWNER'S TELEPHONE COMPANY CONTRACTOR.

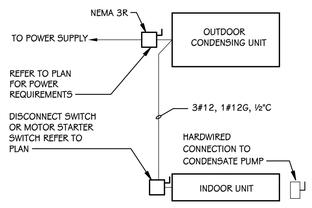
FIRE ALARM SYSTEM RISER DIAGRAM
SCALE: NONE



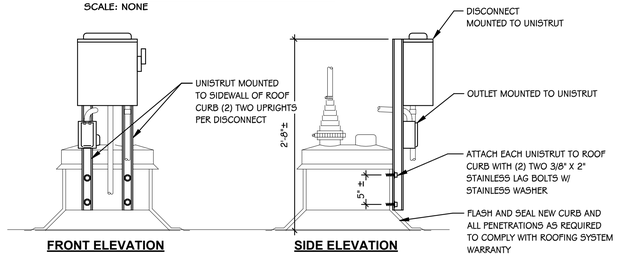
CIRCULATOR PUMP CONTROL
SCALE: NONE



EXHAUST FAN CONTROL
SCALE: NONE



TYPICAL AC SPLIT SYSTEM
SCALE: NONE



DISCONNECT MOUNTING DETAIL - ROOF
SCALE: NONE

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OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

SHEET TITLE
ELECTRICAL CONNECTION SCHEDULES

DATE
DECEMBER 8, 2025

SHEET NUMBER
E 402
23-626.00

EXISTING PANELBOARD " EL1" LOAD SCHEDULE

EXISTING PANEL: EL1 **MOUNTING:** SURFACE **VOLTAGE:** 480/277V, 3PH, 4W
LOCATION: ELEC TUNNEL **AMPS:** 60 A MB **FED FROM:**
A.I.C. VALUE: 18 KAIC

	CIRCUIT DESCRIPTION	TRIP (A)	POLES	A (VA)		B (VA)		C (VA)		POLES	TRIP (A)	CIRCUIT DESCRIPTION	
1	EXISTING - LIGHTING	20	1	1226	1150					1	20	EXISTING - LIGHTING	2
3	EM LIGHTING - VESTIBULE 100D	20	1			322	1768			1	20	EXISTING - LIGHTING	4
5	EXISTING - LIGHTING	20	1					0	2037	1	20	EXISTING - LIGHTING	6
7	SPARE	20	1	0	2750					1	20	EXISTING - LIGHTING	8
9	EXISTING - LIGHTING	20	1			1885	300			1	20	EXISTING - LIGHTING	10
11													12
13													14
15													16
17													18
19													20
21													22
23													24
25													26
27													28
29													30
31													32
33													34
35													36
37													38
39													40
41													42
	TOTAL LOAD:			5126 VA		4275 VA		2037 VA					
	TOTAL AMPS:			20 A		17 A		7 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Spare	11116 VA	100.00%	11116 VA		
EM LIGHTING -	322 VA	100.00%	322 VA	**TOTAL CONNECTED LOAD:**	11438 VA
				TOTAL ESTIMATED DEMAND:	11438 VA
				TOTAL CONNECTED LOAD (A):	14 A
				TOTAL ESTIMATED DEMAND...	14 A

NOTES:

RECEPTACLE DEMAND FACTOR = FIRST 10kVA X 100% + 50% OF REMAINDER

PANELBOARD " EP3" LOAD SCHEDULE

PANEL: EP3 **MOUNTING:** SURFACE **VOLTAGE:** 208/120V, 3PH, 4W
LOCATION: ELEC TUNNEL **AMPS:** 100 A MB **FED FROM:** TX-EP3
ADDED ACCESSORIES: SPD **FEED-THRU LUGS...** No **A.I.C. VALUE:** 3960 A
(PROVIDE 25% HIGHER A.I.C. RATING)

	CIRCUIT DESCRIPTION	TRIP (A)	POLES	A		B		C		POLES	TRIP (A)	CIRCUIT DESCRIPTION	
1	RECEPTACLE - CAMPUS SAFETY 120	20	1	540	500					1	20	POWER - FACP (NEW)	2
3	RECEPTACLE - CAMPUS SAFETY 120	20	1			540	1200			1	20	HVAC - CUH-2	4
5	HVAC - CUH-1	20	1					660	360	1	20	RECEPTACLE - RECEPTION 100	6
7	RECEPTACLE - RECEPTION 100	20	1	540	540					1	20	RECEPTACLE - RECEPTION 100	8
9	RECEPTACLE - TECH RACK	20	1			180	900			1	20	RECEPTACLE - HEALTH 100A	10
11	RECEPTACLE - TV	20	1					360	180	1	20	RECEPTACLE - COPIER	12
13	RECEPTACLE - FILES 101A	20	1	720	720					1	20	RECEPTACLE - WORK ROOM 101	14
15	RECEPTACLE - WORK ROOM 101	20	1			540	720			1	20	RECEPTACLE - CONFERENCE 101B	16
17	RECEPTACLE - TOILET RMs 100C, 100B	20	1					360	540	1	20	RECEPTACLE - CONFERENCE 101E	18
19	RECEPTACLE - PRINCIPAL 101C	20	1	720	720					1	20	RECEPTACLE - PRINCIPAL 101C	20
21	RECEPTACLE - CONFERENCE 101D	20	1			900	540			1	20	RECEPTACLE - CONFERENCE 102B	22
23	RECEPTACLE - LARGE CONFERENCE 102	20	1					720	720	1	20	RECEPTACLE - STOR. 102A	24
25	RECEPTACLE - LARGE CONFERENCE 102	20	1	1560	0					1	20	SPARE	26
27	RECEPTACLE - LARGE CONFERENCE 102	20	1			540	0			1	20	SPARE	28
29	HVAC - EF-1	20	1					180	0	1	20	SPARE	30
31	HVAC - EF-3	20	1	180	0					1	20	SPARE	32
33	POWER - DIGITAL SIGN (MAPLE ST)	20	1			500	0			1	20	SPARE	34
35	SPARE	20	1					0	0	1	20	SPARE	36
37	SPARE	20	1	0	0					1	20	SPARE	38
39	SPARE	20	1			0	0			1	20	SPARE	40
41	SPARE	20	1					0	0	1	20	SPARE	42
A1 43	SPARE	20	1	0	--					1	--	SPACE	44
45	HVAC - CP-1	15	2			832	--			1	--	SPACE	46
47	--	--	--					832	--	1	--	SPACE	48
49	SPD	30	3	0	--					1	--	SPACE	50
51	--	--	--			0	--			1	--	SPACE	52
53	--	--	--					0	--	1	--	SPACE	54
	TOTAL LOAD:			6740 VA		7392 VA		4912 VA					
	ADDITIONAL FEED THRU LUGS LOAD (IF APPLICABLE):			0 VA		0 VA		0 VA					
	TOTAL AMPS:			59 A		64 A		41 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC -	2264 VA	100.00%	2264 VA		
POWER -	1000 VA	100.00%	1000 VA	**TOTAL CONNECTED LOAD:**	19044 VA
RECEPTACLE -	15780 VA	81.69%	12890 VA	**TOTAL ESTIMATED DEMAND:**	16154 VA
				TOTAL CONNECTED LOAD (A):	53 A
				TOTAL ESTIMATED DEMAND...	45 A

NOTES:

PROVIDE SPD BREAKER PER ONELINE SCHEDULE. RECEPTACLE DEMAND FACTOR = FIRST 10kVA X 100% + 50% OF REMAINDER
AIC RATING IS CALCULATED VALUE, PROVIDE IC RATING AT LEAST 25% HIGHER AS PER SPECIFICATIONS.

EXISTING PANELBOARD "EXIST K" LOAD SCHEDULE

EXISTING PANEL: K **MOUNTING:** SURFACE **VOLTAGE:** 208/120V, 3PH, 4W
LOCATION: Level 1 **AMPS:** 400 A MLO **FED FROM:** MDP
A.I.C. VALUE: 6437 A

	CIRCUIT DESCRIPTION	TRIP (A)	POLES	A (VA)		B (VA)		C (VA)		POLES	TRIP (A)	CIRCUIT DESCRIPTION	
1	SPARE	20	1	800	0					1	20	SPARE	2
3	SPARE	20	1			400	0			1	20	SPARE	4
5	SPARE	20	1					1500	0	1	20	RECEPTACLE - 415	6
7	SPARE	20	1	600	0					1	20	SPARE	8
9	SPARE	20	1			400	0			3	20	POWER - DISHWASHER	10
11	SPARE	20	1					400	0	--	--	--	12
13	SPARE	20	1	600	0					--	--	--	14
15	POWER - EF 415	20	3			838	0			1	20	RECEPTACLE - 406	16
17	--	--	--					838	0	1	20	RECEPTACLE - 415	18
19	--	--	--	838	0					1	20	RECEPTACLE - 421	20
21	SPARE	20	1			720	0			1	20	RECEPTACLE - 415	22
23	SPARE	20	1					720	0	1	20	RECEPTACLE - 415	24
25	EXISTING	20	1	0	0					1	20	EXISTING	26
27	EXISTING	20	1			0	0			1	20	SPARE	28
29	SPARE	20	1					0	0	3	20	EXISTING	30
31	EXISTING	20	3	0	0					--	--	--	32
33	--	--	--			0	0			--	--	--	34
35	--	--	--					0	0	1	20	EXISTING	36
37	EXISTING	20	1	0	0					1	20	EXISTING	38
39	EXISTING	20	1			0	0			1	20	EXISTING	40
41	EXISTING	20	1					0	0	1	20	EXISTING	42
43	HVAC	20	1	0	900					**1**	**20**	**RECEPTACLE - STORAGE 402C**	44
45	HVAC	20	1			0	2500			**3**	**30**	**HVAC - EUH-1**	46
47	RECEPTACLE	20	1					180	2500	--	--	--	48
49	SPACE	--	1	--	2500					--	--	--	50
51	RECEPTACLE	20	1			360	180			**1**	**20**	**HVAC - EF-2**	52
53	RECEPTACLE	20	1					360	0	1	20	SPARE	54
55	RECEPTACLE	20	1	360	0					1	20	SPARE	56
57	SPACE	--	1			--	0			1	20	SPARE	58
59	SPACE	--	1					--	--	1	--	SPACE	60
61	SPACE	--	1	--	--					1	--	SPACE	62
63	SPACE	--	1			--	--			1	--	SPACE	64
65	SPACE	--	1					--	--	1	--	SPACE	66
67	SPACE	--	1	--	--					1	--	SPACE	68
69	SPACE	--	1			--	--			1	--	SPACE	70
71	SPACE	--	1					--	--	1	--	SPACE	72
73	SPACE	--	1	--	--					1	--	SPACE	74
75	SPACE	--	1			--	--			1	--	SPACE	76
77	SPACE	--	1					--	--	1	--	SPACE	78
79	SPACE	--	1	--	--					1	--	SPACE	80
81	SPACE	--	1			--	--			1	--	SPACE	82
83	SPACE	--	1					--	--	1	--	SPACE	84
	TOTAL LOAD:			6598 VA		5398 VA		6498 VA					
	TOTAL AMPS:			56 A		45 A		56 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC -	7680 VA	100.00%	7680 VA		
RECEPTACLE -	900 VA	100.00%	900 VA	**TOTAL CONNECTED LOAD:**	18494 VA
Spare	9914 VA	100.00%	9914 VA	**TOTAL ESTIMATED DEMAND:**	18494 VA
				TOTAL CONNECTED LOAD (A):	51 A
				TOTAL ESTIMATED DEMAND...	51 A

NOTES: CIRCUITS IN BOLD REPRESENT NEW CIRCUIT IN EXISTING PANEL.

PROVIDE SPD BREAKER PER ONELINE SCHEDULE. RECEPTACLE DEMAND FACTOR = FIRST 10kVA X 100% + 50% OF REMAINDER

EXISTING PANELBOARD " EM1" LOAD SCHEDULE

EXISTING PANEL: EM1 **MOUNTING:** SURFACE **VOLTAGE:** 480/277V, 3PH, 4W
LOCATION: ELEC TUNNEL **AMPS:** 125 A MB **FED FROM:** ATS-EM1
A.I.C. VALUE: 4579 A

	CIRCUIT DESCRIPTION	TRIP (A)	POLES	A (VA)		B (VA)		C (VA)		POLES	TRIP (A)	CIRCUIT DESCRIPTION	
1	EXISTING - LIGHTING	20	1	2849	3212					1	20	EXISTING - LIGHTING	2
3	EXISTING - LIGHTING	20	1			2849	3071			1	20	EXISTING - LIGHTING	4
5	EXISTING - LIGHTING	20	1					2552	2877	1	20	EXISTING - LIGHTING	6
7	EXISTING - LIGHTING	20	1	3661	3132					1	20	EXISTING - LIGHTING	8
9	EXISTING - LIGHTING	20	1			2664	3176			1	20	EXISTING - LIGHTING	10
11	EM2	60	3					6156	1814	3	30	TX-EP1	12
13	--	--	--	5714	1440					--	--	--	14
15	--	--	--			3159	1900			--	--	--	16
17	TX-EP2	30	3					3588	845	1	20	EXISTING - LIGHTING	18
19	--	--	--	2368	728					1	20	EXISTING - LIGHTING	20
21	--	--	--			1444	0			1	20	SPARE	22
23	EXISTING - LIGHTING	20	1					2760	0	1	20	SPARE	24
25	LIGHTING - MAIN OFFICE	20	1	959	0					1	20	SPARE	26
27	EXISTING - SITE LIGHTING	20	1			767	933			1	20	EXISTING - SITELIGHTING	28
29	SPARE	20	1					0	0	1	20	SPARE	30
31	SPARE	20	1	0	0					1	20	SPARE	32
33	EXISTING - LIGHTING	20	1			2761	0			1	20	SPARE	34
35	SPARE	20	1					0	0	1	20	SPARE	36
37	**TX-EP3**	**45**	**3**	6740	0					1	20	SPARE	38
39	**--**	**--**	**--**			7392	0			1	20	SPARE	40
41	**--**	**--**	**--**					4912	0	1	20	SPARE	42
	TOTAL LOAD:			30803 VA		30116 VA		25504 VA					
	TOTAL AMPS:			114 A		111 A		92 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC -	2264 VA	100.00%	2264 VA		
LIGHTING -	959 VA	100.00%	959 VA	**TOTAL CONNECTED LOAD:**	86423 VA
POWER -	1000 VA	100.00%	1000 VA	**TOTAL ESTIMATED DEMAND:**	83533 VA
RECEPTACLE -	15780 VA	81.69%	12890 VA	**TOTAL CONNECTED LOAD (A):**	104 A
Spare	66420 VA	100.00%	66420 VA	**TOTAL ESTIMATED DEMAND...**	100 A

NOTES: PROVIDE NEW BREAKER IN EXISTING PANELBOARD

RECEPTACLE DEMAND FACTOR = FIRST 10kVA X 100% + 50% OF REMAINDER

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PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS
OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

DATE
DECEMBER 8, 2025

SHEET TITLE
ELECTRICAL PANEL LOAD SHEETS

SHEET NUMBER
E 501
23-626.00

TECHNOLOGY PROVISION MATRIX

DEVICE TYPE	OWNER PROVIDED	OWNER INSTALLED	CM PROVIDED / INSTALLED	CONTRACTOR PROVIDED	CONTRACTOR INSTALLED	COMMENTS
ELECTRIFIED DOOR HARDWARE				X	X	PROVIDED BY DOOR HARDWARE MANUFACTURER.
DEMOLITION OF EXISTING TECHNOLOGY DEVICES, MOUNTING HARDWARE, AND CABLING				X	X	
GROUNDING BUSBARS IN TELECOM ROOMS				X	X	
PATHWAY FOR COMMUNICATIONS (CONDUIT, SLEEVES, ROUGH-IN BOXES, ETC.)			X			
CABLE TRAY (OUTSIDE TELECOM ROOMS)				X	X	
CABLE TRAY (INSIDE TELECOM ROOMS)				X	X	
UPS DEVICES				X	X	
PLYWOOD BACKERBOARD (INSIDE TELECOM ROOMS)				X	X	
NETWORK RACKS				X	X	
BACKBONE DATA CABLING & TERMINATIONS				X	X	
HORIZONTAL DATA CABLING & TERMINATIONS				X	X	
NETWORK EQUIPMENT (SWITCHES, PATCH PANELS & WIRELESS ACCESS POINTS)	X	X				
AV EQUIPMENT, MOUNTING HARDWARE, FACEPLATES, & CABLING				X	X	
SOUND-MASKING SYSTEM (DEVICES & CABLING)				X	X	
SECURITY INTERCOM & CABLING				X	X	
CLOCKS & CABLING				X	X	
ACCESS CONTROL SYSTEM (ENCLOSURES, READERS, SENSORS, POWER SUPPLIES, CABLING, ETC.)				X	X	
SECURITY CAMERAS & CABLING				X	X	

STRUCTURED CABLING — MOUNTING HEIGHTS

	DATA/VOICE OUTLET - 4 SQ BOX, 5G COVER, 1" CONDUIT STUB	16"
	DATA/VOICE OUTLET - 4 SQ BOX, 5G COVER, SURFACE #WM500	16"
	DATA/VOICE OUTLET - 4 SQ BOX, 5G COVER, 1" CONDUIT STUB 4" ABOVE BACKSPLASH	
	SECURITY CONTROLS PATHWAY - 4 SQ BOX, 5G COVER WITH BRUSH PLATE, 1" CONDUIT STUB	16"
WAP	WIRELESS ACCESS POINT (REFER TO DETAILS)	
GRD	GROUNDING BUS BAR WITH DEDICATED GROUND, (REFER TO DETAILS)	
	CABLE TRAY, (12"x4" UNLESS NOTED OTHERWISE)	
	CLOCK (REFER TO DETAILS)	90" TO CENTER
MCP	MASTER CLOCK PANEL	
PAG	PAGING SYSTEM HEAD END	
TC#	NETWORK COMMUNICATION RACK - FLOOR STANDING 3' CLEAR ON BOTH SIDES	
	4'X8'X3/4" FIRE-RATED PLYWOOD, A/C FINISH, MOUNT VERTICALLY	12"
	CONDUIT SLEEVE IN ACCESSIBLE CEILING (2" CONDUIT UNLESS NOTED OTHERWISE, ONLY SHOWN ON PLANS INDICATING SPECIFIC CONDITIONS, REFER TO GENERAL NOTES FOR SLEEVES THAT ARE REQUIRED INTO ALL SPACES)	

AUDIO/VISUAL

TV n	TV WALL RECESSED "FSR" BACKBOX, (REFER TO DETAILS)	
PJ n	PROJECTOR, (REFER TO DETAILS)	
AV n	A/V WALL STATION BOXES, USE FSR MUDRING MUD-2G-** FOR 2-GANG OPENINGS (REFER TO DETAILS)	
TS n	TECHNOLOGY OR TEACHER'S STATION BOXES, USE FSR MUDRING MUD-2G-** FOR 2-GANG OPENINGS(REFER TO DETAILS)	
MIC	MICROPHONE JACK	16"
CB	CEILING BOX, (REFER TO DETAILS)	
BT	BLUETOOTH DEVICE - DEEP 4 SQ BOX, 1-G OPENING, (REFER TO DETAILS)	40"
ANT	ANTENNA, (REFER TO DETAILS)	
SCR	PROJECTOR SCREEN, (REFER TO DETAILS)	
S	PAGNIG LOUDSPEAKER CEILING - MOUNTED	
S	PAGING LOUDSPEAKER WALL - MOUNTED	
VC	VOLUME CONTROL	40"

SECURITY SYMBOLS

	SECURITY CAMERA - WALL	
	SECURITY CAMERA - CEILING	
SCP	SECURITY CABLING PATHWAY, 4 SQ, 5G BRUSH PLATE, 1" CONDUIT STUB	16"
ACP#	ACCESS CONTROL PANEL (REFER TO DETAILS)	
RB	RELEASE BUTTON - "#" DENOTES QUANTITY AT LOCATION	
IM	INTERCOM MASTER STATION	
LD	LOCKDOWN BUTTON	
DA	DURESS ALARM PUSH BUTTON - UNDER DESK	
CR	CARD READER - 4 SQ BOX, 5G COVER, 3/4" CONDUIT STUB	40"
CR M	CARD READER, MULLION MOUNT, 3/4" CONDUIT STUB	40"
LS	LOCKDOWN STROBE (REFER TO DETAILS)	
KP	KEY PAD - 4 SQ BOX, 5G COVER, 3/4" CONDUIT STUB	40"
IC	INTERCOM - 4 SQ BOX, 5G COVER, 3/4" CONDUIT STUB	40"
n	ACCESS CONTROL DETAIL INDICATOR: REFER TO ACCESS CONTROL DETAILS AND SCHEDULE	

NOTES:

MOUNT DEVICES AT HEIGHTS INDICATED UNLESS INDICATED OTHERWISE ON PLANS. HEIGHTS ARE TO BOTTOM OF DEVICE.

GENERAL NOTES - VIDEO SYSTEM

1 INSTALLED VIDEO SYSTEMS SHALL NOT HAVE NOISE, FLICKER, UNEVEN BRIGHTNESS, OR ANY OTHER VISUAL ANOMALIES OR DEFICIENCIES

2 EDID SHALL BE MANAGED AND MAINTAINED TO ENSURE PROPER DISPLAY IDENTIFICATION BY SOURCES

3 HDCP SHALL BE MAINTAINED FROM ALL SOURCES TO ALL SINKS

4 COORDINATE ALL NETWORK NEEDS WITH OWNER INCLUDING IP ADDRESSING, PROTOCOLS REQUIRED FOR EQUIPMENT OPERATION, AND BANDWIDTH IMPLICATIONS

GENERAL NOTES - ACCESS CONTROLS

1 ALL INSTALLATION AND PROGRAMMING SHALL BE COMPLETED BY OR OVERSEEN BY A MANUFACTURER CERTIFIED INSTALLER.

2 PRIOR TO CONNECTING ANY DEVICE TO THE NETWORK, DEFAULT USERNAMES AND PASSWORDS SHALL BE CHANGED TO OWNER'S STANDARDS.

3 CABLES SHALL BE NEATLY MANAGED AND LABELED WITHIN ACCESS CONTROL PANELS. ZIP TIES ARE NOT ACCEPTABLE METHODS OF CABLE MANAGEMENT.

4 EACH ACCESS CONTROL CABLE SHALL BE LABELED WITH THEIR FUNCTION AT THE ACCESS CONTROL PANEL. REFER TO ACCESS CONTROL LABELING DETAILS FOR REQUIREMENTS.

5 UNLESS NOTED OTHERWISE, POWER SUPPLIES SHALL BE HARD WIRED AND NOT CORD AND PLUG. COORDINATE WITH ELECTRICAL CONTRACTOR TO CONNECT TO AN EMERGENCY OR GENERATOR-FED CIRCUIT.

6 COORDINATE WITH OWNER TO PROGRAM DOORS AND DEVICES ACCORDING TO OWNER'S NAMING CONVENTIONS.

7 REFER TO ACCESS CONTROL SCHEDULE FOR PROGRAMMING REQUIREMENTS OF EACH DOOR.

8 ANY SPARE CONDUCTORS/CABLES SHALL BE SPOOLED ABOVE ACCESSIBLE CEILING NEAR DOOR AND LABELED WITH THE DOOR NUMBER AND PANEL NUMBER, AS WELL AS "SPARE".

GENERAL NOTES - AUDIO SYSTEM

1 AUDIO SYSTEM SHALL BE FREE OF NOISE, RATTLE, HUM, BUZZ, OR ANY OTHER AUDIO DISTORTIONS

2 SECURE CABLES UTILIZING VELCRO STRAPS. WIRE "ZIP TIES" SHALL NOT BE USED

3 ROUTE ALL CABLES IN A MANNER THAT WILL ENSURE SIGNAL INTEGRITY AND WILL NOT INTRODUCE CROSSTALK

4 PROVIDE A SERVICE LOOP FOR RACKS AND EQUIPMENT SUITABLE TO EASILY PLUG AND UNPLUG EQUIPMENT FOR TROUBLESHOOTING OR REPLACEMENT

5 NEATLY DRESS ALL CABLING INSTALLED INSIDE AND OUTSIDE OF RACKS IN A SUITABLE HARNESS TO KEEP CABLES CLEAN, NEAT, AND TIDY

6 COMMISSION AUDIO SYSTEM USING AUDIO MEASUREMENT MICROPHONE AND SOFTWARE (SMAART OR EASERA)

7 ADJUST EQ AND CROSSOVER SETTINGS IN AMPLIFIER AND/OR DSP TO PROVIDE FLAT FREQUENCE RESPONSE, FULL RANGE AUDIO WITH PROTECTIVE LIMITING

8 USE SPEECH, HIGH QUALITY REFERENCE AUDIO, AND SINE WAVE SWEEPS TO TEST THE SYSTEM - CORRECT ANY ABNORMALITIES

9 VERIFY PROPER FUNCTION OF ALL INSTALLED EQUIPMENT (NEW AND EXISTING)

10 TURN OVER EXISTING UNUSED EQUIPMENT TO OWNER - NEATLY ORGANIZED

11 COORDINATE WITH OWNER FOR LABELING OF EQUIPMENT AND AUDIO CONSOLE CHANNELS AND BUSSES AS WELL AS CONSOLE CONFIGURATION

12 REMOTE MOUNT ALL ANTENNAS AS REQUIRED FOR MAXIMUM PERFORMANCE

13 CONFIGURE DELAYS ON ANY SPEAKERS THAT ARE STAGGERED IN A LISTENING PLANE TO TIME-ALIGN AUDIO

14 CONNECT COMPONENTS TO POWER SEQUENCER IN SUCH A WAY AS TO MITIGATE POPPING AND SYSTEM DAMAGE DURING SYSTEM POWER UP AND POWER DOWN

GENERAL NOTES - PAGING AND CLOCK

1 FOR CLOCKS REQUIRING A MANUFACTURER-SPECIFIC IN-WALL ROUGH-IN BOX, THE CLOCK CONTRACTOR SHALL PROVIDE THE ROUGH-IN BOX TO ELECTRICIAN FOR WALL INSTALLATION. THE CLOCK CONTRACTOR AND ELECTRICIAN SHALL COORDINATE AHEAD OF SCHEDULED WALL INSTALLATIONS. COORDINATE WITH CONSTRUCTION MANAGER.

2 PAGING AND CLOCK CONTROLLERS SHALL BE PROPERLY CONFIGURED FOR TIME SYNCHRONIZATION WITH OWNER'S NETWORK TIME PROTOCOL (NTP) SOURCE. COORDINATE NTP ADDRESS WITH OWNER.

3 PAGING SPEAKER CABLING SHALL BE SIZED APPROPRIATELY FOR CABLE LENGTH AND POWER LOAD OF A GIVEN CIRCUIT.

4 FOR WIRELESS CLOCK SYSTEMS THAT REQUIRE FCC LICENSURE, THE CLOCK INTEGRATOR SHALL COORDINATE ANY REQUIRED LICENSE APPLICATION FORMS THAT ARE REQUIRED TO BE COMPLETED BY THE OWNER.

5 THE CLOCK INTEGRATOR SHALL BE RESPONSIBLE FOR REVIEW OF THE PROJECT ARCHITECTURAL ELEVATIONS AND ADHERE TO CLOCK PLACEMENT/ALIGNMENT GUIDELINES. ANY PLACEMENT CLARIFICATION REQUESTS SHALL BE MADE BY RFI.

6 FOR INTEGRATION OF NEW PAGING HEADEND HARDWARE TO PRE-EXISTING PAGING CIRCUITS, THE PAGING INTEGRATOR SHALL PERFORM A PRE-INSTALLATION SPEAKER TEST OF ALL EXISTING SPEAKERS. ANY FAULTY EXISTING SPEAKERS SHALL BE NOTED AND COMMUNICATED TO THE CM/ARCHITECT PRIOR TO THE INSTALLATION OF NEW EQUIPMENT.

7 THE PAGING SYSTEM INTEGRATOR SHALL PROVIDE INTERCONNECTION CABLING TO THE PRIMARY FIRE ALARM PANEL TO ALLOW THE FIRE ALARM SYSTEM TO OVERRIDE PAGING. CONNECTION AT THE FIRE PANEL SHALL BE BY THE FIRE ALARM INTEGRATOR. COORDINATE WITH OTHER TRADES.

8 THE PAGING SYSTEM RISER DETAIL IS INTENDED TO BE DIAGRAMMATICAL FOR THE PURPOSE OF UNDERSTANDING THE BASIC SYSTEM ARCHITECTURE. THE PAGING INTEGRATOR SHALL PROVIDE ALL COMPONENTS, CABLES AND ADAPTERS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM, REGARDLESS IF SHOWN ON THE DIAGRAM.

GENERAL NOTES - TECHNOLOGY

1 TECHNOLOGY CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED FOR NEW WORK OR WHERE DEVICES ARE REMOVED AND NOT REPLACED.

2 TECHNOLOGY CONTRACTOR SHALL COORDINATE WITH G SERIES SHEETS DEVICE COORDINATION DETAIL. DEVICES ARE TO ALIGN VERTICALLY AND HORIZONTALLY AND FOLLOW THE RULES OF THIS DETAIL CONSISTENTLY. A PRE-INSTALL DEVICE COORDINATION MEETING FOR DEVICE FINISHES AND LAYOUT MAY BE REQUIRED IN THE SPECIFICATION FOR THIS PROJECT.

3 REFER TO TECHNOLOGY, ELECTRICAL AND ARCHITECTURAL DETAILS AND ELEVATIONS FOR SYMBOL INFORMATION AND ELEVATION DETAIL.

4 DEVICES AND EQUIPMENT SHOWN DASHED OR WITH AN "X" ARE TO BE REMOVED. FIXTURES, DEVICES AND EQUIPMENT SHOWN LIGHTLY OR WITH AN "E" ARE EXISTING TO REMAIN UNDISTURBED.

5 DEVICES SHOWN WITH AN "R" ARE EXISTING TO BE REPLACED WITH NEW DEVICE AND COVERPLATE.

6 TEMPORARILY SUPPORT EXISTING CEILING DEVICES TO REMAIN IN EXISTING CEILINGS TO BE REPLACED. REINSTALL DEVICES INTO NEW CEILING.

7 CONTRACTOR SHALL BE RESPONSIBLE FOR PROJECT PHASING. TEMPORARY WIRING TO KEEP SYSTEMS RUNNING SHALL BE PROVIDED AS REQUIRED WHILE BUILDING IS OCCUPIED BETWEEN PHASES OF CONSTRUCTION.

GENERAL NOTES - STRUCTURED CABLE

1 BICSI TECHNICIAN (TECH) CERTIFICATION IS REQUIRED FOR THE LEAD INSTALLER THAT WILL BE ONSITE AT ALL TIMES.

2 EACH INSTALLER IS REQUIRED TO BE CERTIFIED BY THE MANUFACTURER OF THE PRODUCTS THAT ARE INSTALLED (I.E. PANDUIT, BELDEN, HUBBELL, COMMSCOPE, ETC.).

3 VALID BICSI TECH AND MANUFACTURER INSTALLER CERTIFICATES SHALL BE INCLUDED IN SUBMITTAL PACKAGE.

4 ALL CERTIFICATION TEST RESULTS OF THE STRUCTURED CABLING SYSTEM SHALL BE SUBMITTED TO TOWERPINKSTER AS PART OF THE CLOSEOUT PACKAGE.

5 STRUCTURED CABLING INTEGRATOR SHALL PROVIDE A MANUFACTURER'S 25 YEAR WARRANTY AT PROJECT COMPLETION.

6 ALL CABLES SHALL HAVE A MINIMUM OF 5FT SERVICE LOOP AT OUTLET LOCATION OR AS NOTED ON DRAWINGS.

7 ALL DATA CABLES SHALL HAVE A MINIMUM OF 5FT SERVICE LOOP IN THE TELECOMMUNICATIONS ROOM.

8 DATA CABLES SHALL NOT BE BUNDLED IN GROUPS OF MORE THAN 24 WITHIN A TELECOMMUNICATIONS ROOM.

9 STRUCTURED CABLING INTEGRATOR SHALL PROVIDE THE MINIMUM REQUIRED QUANTITY OF PATCH PANELS NEEDED FOR ALL DATA CABLES PLUS HAVE CAPACITY FOR A MINIMUM OF 20 FUTURE DATA CABLES.

10 ALL DATA FACEPLATES SHALL MATCH THE COLOR, STYLE AND MATERIAL (I.E. STAINLESS STEEL, PLASTIC, ETC.) OF THE ELECTRICAL DEVICE FACEPLATE WITHIN EACH SPACE.

11 ALL HORIZONTAL CABLES (CATEGORY CABLE, COAX, FIBER, ETC.) SHALL BE CERTIFIED BY USING A MINIMUM OF A LEVEL IIIE CERTIFICATION TESTER THAT IS WITHIN MANUFACTURER'S CALIBRATION PERIOD.

12 ALL BACKBONE FIBER STRANDS SHALL BE CERTIFIED BY USING A MINIMUM OF A LEVEL IIIE CERTIFICATION TESTER THAT IS WITHIN MANUFACTURER'S CALIBRATION PERIOD.

GENERAL NOTES - SECURITY CAMERA

1 INSTALLATION SHALL BE COMPLETED BY OR OVERSEEN BY A MANUFACTURER CERTIFIED PROFESSIONAL.

2 INSTALL CAMERAS USING ALL APPROPRIATE HANGERS, FASTENERS, ETC. CAMERAS INSTALLED IN GRID/LAY IN CEILING SHALL HAVE SAFETY WIRE TYING THE CAMERA TO STRUCTURE ABOVE. EXTERIOR CAMERAS SHALL HAVE WEATHERTIGHT SEALANT AND SURGE SUPPRESSION INSTALLED. REFER TO CAMERA ROUGH IN DETAILS.

3 PRIOR TO CONNECTION TO OWNER'S NETWORK, DEFAULT USERNAME AND PASSWORD SHALL BE CHANGED. COORDINATE WITH OWNER FOR DEVICE SPECIFIC USERNAMES AND PASSWORDS.

4 CAMERA SHALL BE CONFIGURED BASED ON OWNER'S NETWORK CONFIGURATION AND NAMING STANDARDS. COMPLETE AN IP ADDRESS REQUEST WITH THE OWNER, COORDINATE NAMING CONFIGURATION BASED ON CAMERA COORDINATION SPREADSHEET.

5 INSTALL CAMERAS WITH INITIAL VIEW DEFINED BY THE CAMERA COORDINATION SPREADSHEET OR COVERAGE ANGLES PROVIDED BY ARCHITECT. VARIFOCAL AIMING WHERE REQUIRED TO OBTAIN INTENDED VIEW SHALL BE COMPLETED.

6 FOLLOWING SETTING THE INITIAL VIEW, COORDINATE AIMING MODIFICATIONS WITH ARCHITECT AND OWNER AND OBTAIN SIGN OFF PER CAMERA THROUGH THE CAMERA AIMING COORDINATION SPREADSHEET.

7 CONFIGURE CAMERA TO RECORD TO NVR BASED ON OWNER'S RECORDING CONFIGURATION STANDARDS. RESOLUTION, FRAMES PER SECOND, CONTINUOUS/MOTION ACTIVATED RECORDING, ANALYTICS, AND ANY OTHER FEATURES SHALL BE COORDINATED.

8 LABEL CAMERA HOUSING IN A LOCATION VISIBLE FROM THE GROUND. REFER TO CAMERA LABELING DETAIL FOR REQUIREMENTS.

9 CAMERA SYMBOLS AND COVERAGE ANGLES SHALL BE SET IN VMS MAPS ONCE OWNER AND ARCHITECT HAVE SIGNED OFF ON VIEWS.

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ADDENDUM #1 02-09-2026

ISSUED FOR DATE

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OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

DATE
DECEMBER 8, 2025

SHEET TITLE
TECHNOLOGY SYMBOLS AND GENERAL NOTES

A1

SHEET NUMBER
TG 001
23-626.00

KEYED NOTES - DEMOLITION - TECHNOLOGY

1 DEVICE SHALL BE REMOVED AND RETURNED TO KPS TECHNOLOGY SERVICES*. DOCUMENT CABLE ID, MAC ADDRESS AND DEVICE LOCATION. COIL CABLE AT CEILING/WALL FOR FUTURE INSTALLATION.

2 REMOVE PAGING SPEAKER AND RECYCLE/DISPOSE OF PROPRELY. COIL CABLE TO CEILING FOR FUTURE INSTALLATION.

3 REMOVE PAGING SPEAKER AND RECYCLE/DISPOSE OF PROPRELY. TRACE CABLE TO SOURCE AND REMOVE.

4 DEVICE SHALL BE REMOVED AND RETURNED TO KPS TECHNOLOGY SERVICES*. DOCUMENT CABLE ID, MAC ADDRESS AND DEVICE LOCATION. TRACE CABLES TO SOURCE AND REMOVE. THIS DEVICE SHALL BE REINSTALLED DURING CONSTRUCTION.

5 TRACE CABLES TO SOURCE AND REMOVE. REMOVE SURFACE RACEWAY.

6 COORDINATE WITH EC TO CAP POWER DURING DEMOLITION AND CONSTRUCITON.

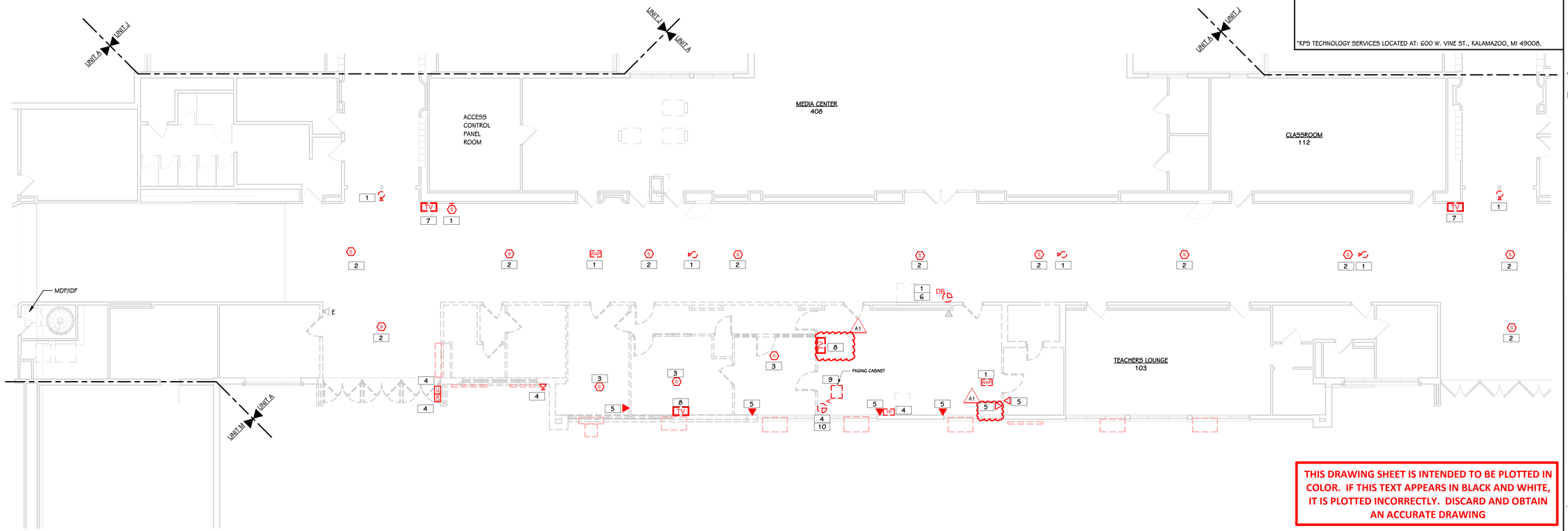
7 REMOVE AND RETURN DISPLAY TO KPS TECHNOLOGY SERVICES*. MOUNT SHALL REMAIN IN PLACE. COIL REMAINING CABLES IN PLACE AND PROTECT CABLES AND MOUNT FOR FUTURE INSTALLATION.

8 REMOVE AND RETURN DISPLAY AND MOUNT TO KPS TECHNOLOGY SERVICES*. TRACE CABLES TO SOURCE AND REMOVE.

9 PAGING CABINET SHALL BE REMOVED AND RETURNED TO KPS TECHNOLOGY SERVICES*. CABLES SHALL BE RUN TO NEW PAGING LOCATION IN NEW RECEPTION. IF CABLES ARE TOO SHORT, TRACE TO SOURCE, REMOVE, AND RUN NEW.

10 EC SHALL DEMO POWER. COORDINATE WITH EC.

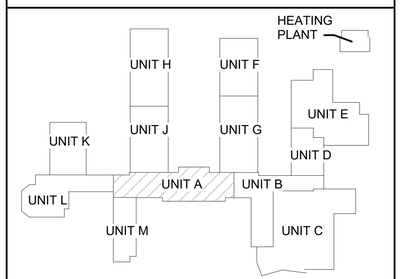
*KPS TECHNOLOGY SERVICES LOCATED AT: 600 W. VINE ST., KALAMAZOO, MI 49008.



THIS DRAWING SHEET IS INTENDED TO BE PLOTTED IN COLOR. IF THIS TEXT APPEARS IN BLACK AND WHITE, IT IS PLOTTED INCORRECTLY. DISCARD AND OBTAIN AN ACCURATE DRAWING

FIRST FLOOR TECHNOLOGY DEMOLITION PLAN - UNIT A
1/8" = 1'-0"

MAPLE STREET



KEY PLAN
SCALE: NO SCALE

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OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

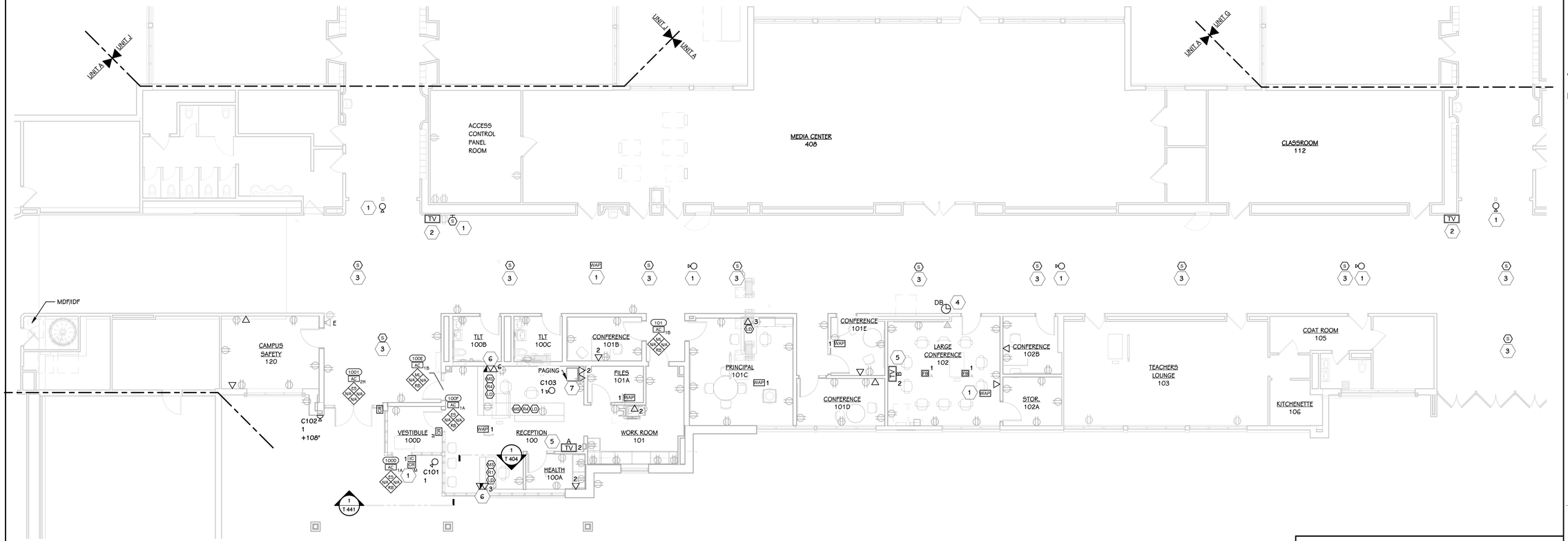
SHEET TITLE
FIRST FLOOR TECHNOLOGY DEMOLITION PLAN - UNIT A

DATE
DECEMBER 8, 2025

SHEET NUMBER
TD 101A
23-626.00

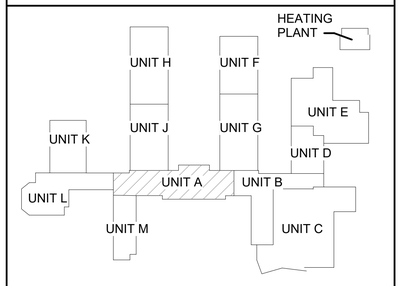
KEYED NOTES - CONSTRUCTION - TECHNOLOGY

1. RETRIEVE DEVICE FROM DEMOLITION FROM KPS TECHNOLOGY SERVICES*. REINSTALL DEVICE AT ORIGINAL LOCATION USING EXISTING CABLING.
2. RETRIEVE DISPLAY FROM DEMOLITION FROM KPS TECHNOLOGY SERVICES*. REINSTALL AT ORIGINAL LOCATION USING EXISTING MOUNT AND CABLING. CONFIRM OPERATION.
3. TECHNOLOGY CONTRACTOR SHALL INSTALL NEW PAGING SPEAKER IN EXISTING LOCATION. USE EXISTING CABLING.
4. TECHNOLOGY CONTRACTOR SHALL RETRIEVE CLOCK FROM KPS TECHNOLOGY SERVICES*. INSTALL CLOCK IN ORIGINAL LOCATION. COORDINATE WITH EC TO CONNECT POWER.
5. TECHNOLOGY CONTRACTOR SHALL RUN DATA CABLING TO THIS LOCATION. QTY PER PLAN. ROUGH-IN PROVIDED BY GC. DISPLAY AND MOUNT SHALL BE INSTALLED BY OWNER AT A LATER DATE.
6. TECHNOLOGY CONTRACTOR SHALL RUN DATA CABLING TO THIS LOCATION. QTY PER PLAN. ROUGH-IN PROVIDED BY GC. SECOND LV BOX SHALL BE PROVIDED BY GC AND USED AS A PATHWAY FOR ACCESS CONTROL CABLING TO LOCKDOWN AND RELEASE BUTTON DEVICES.
7. TECHNOLOGY CONTRACTOR SHALL RETRIEVE PAGING EQUIPMENT RACK FROM KPS TECHNOLOGY SERVICES*. RUN ALL CABLING TO THIS LOCATION FROM PREVIOUS LOCATION. IF CABLING IS TOO SHORT, TRACE TO SOURCE, REMOVE, AND RUN NEW.



FIRST FLOOR TECHNOLOGY PLAN - UNIT A
1/8" = 1'-0"

MAPLE STREET



KEY PLAN
SCALE: NO SCALE

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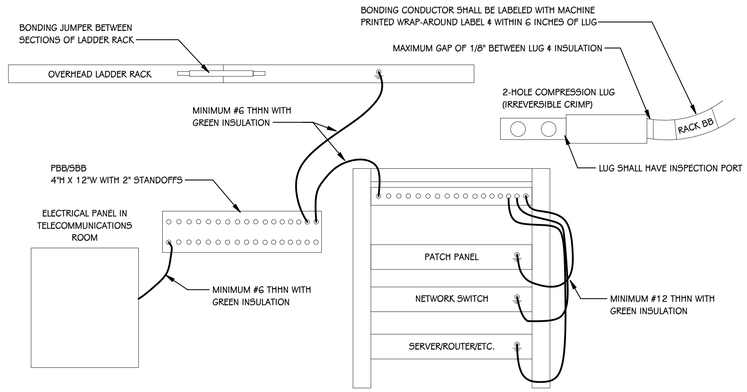
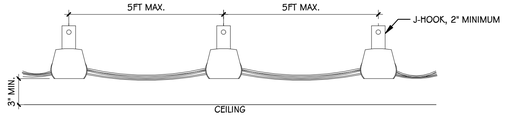


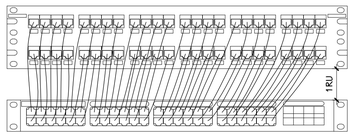
TELECOMMUNICATION ROOM BONDING DETAIL

SCALE: NONE



CABLE SUPPORT DETAIL

SCALE: NONE

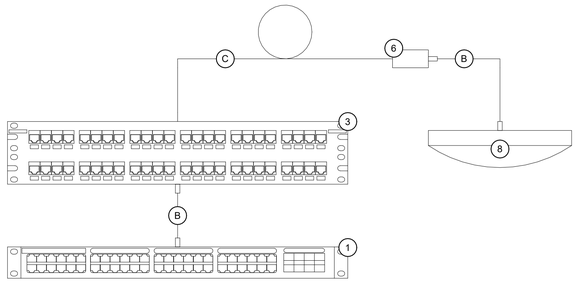


INSTALL 1FT PATCH CORDS BETWEEN PATCH PANEL AND NETWORK SWITCH.

SWITCH PORT NUMBER SHALL CONNECTO TO SAME PORT NUMBER ON PATCH PANEL.

SWITCH - PATCH PANEL CROSS CONNECT SAMPLE

SCALE: NONE



TECHNOLOGY LABEL NOMENCLATURE:

TECHNOLOGY CLOSET / ROOM — TC

TV — TC-2A-#/# A

- TECHNOLOGY DEVICE LABEL (SEE BELOW)
- DETAIL DESIGNATION (KEYED TO DETAIL)
- TECHNOLOGY SYMBOL (REFER TO SYMBOL LEGEND AND RESPECTIVE DETAIL)

TECHNOLOGY DEVICE LABEL NOMENCLATURE:

TC-2A-#/##

- /# - NUMBER OF POTS LINES
- # - NUMBER OF DATA DROPS
- A - SEQUENCE OR AREA
- 2 - FLOOR LEVEL (OMITTED IF SINGLE)
- TC - TECHNOLOGY CLOSET OR ROOM

CLOSET / ROOM LABEL NOMENCLATURE:

TC-2A

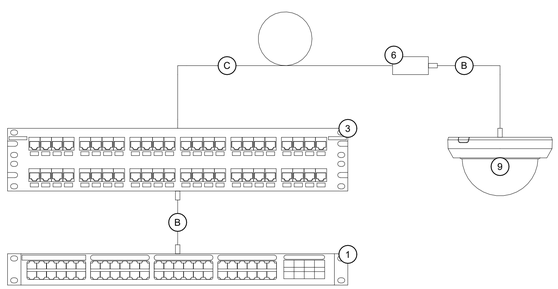
- A - SEQUENCE OR AREA
- 2 - FLOOR LEVEL (OMITTED IF SINGLE)
- TC - TECHNOLOGY CLOSET OR ROOM

INTERIOR WIRELESS ACCESS POINT CABLING DETAIL

SCALE: NONE

INTERIOR WAP EQUIPMENT SCHEDULE

KEY #	DESCRIPTION	COMMENTS
1	NETWORK SWITCH	EXISTING/PROVIDED BY OWNER
3	PATCH PANEL	EXISTING/PROVIDED BY OWNER
6	SURFACE MOUNT BOX	REFER TO FACEPLATE & SURFACE BOX SCHEDULE
8	WIRELESS ACCESS POINT	EXISTING/PROVIDED BY OWNER
B	PATCH CORD	REFER TO PATCH CORD SCHEDULE
C	CATEGORY CABLE	REFER TO DATA CABLE SCHEDULE. INCLUDE SERVICE LOOP

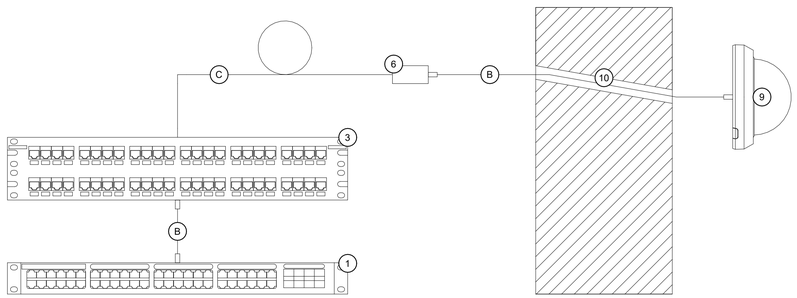


INTERIOR SECURITY CAMERA CABLING DETAIL

SCALE: NONE

INTERIOR CAMERA EQUIPMENT SCHEDULE

KEY #	DESCRIPTION	COMMENTS
1	NETWORK SWITCH	EXISTING/PROVIDED BY OWNER
3	PATCH PANEL	EXISTING/PROVIDED BY OWNER
6	SURFACE MOUNT BOX	REFER TO FACEPLATE & SURFACE BOX SCHEDULE
9	CAMERA	EXISTING/REFER TO SECURITY CAMERA SCHEDULE
B	PATCH CORD	REFER TO PATCH CORD SCHEDULE
C	CATEGORY CABLE	REFER TO DATA CABLE SCHEDULE. INCLUDE SERVICE LOOP



EXTERIOR SECURITY CAMERA CABLING DETAIL

SCALE: NONE

EXTERIOR CAMERA EQUIPMENT SCHEDULE

KEY #	DESCRIPTION	COMMENTS
1	NETWORK SWITCH	EXISTING/PROVIDED BY OWNER
3	PATCH PANEL	EXISTING/PROVIDED BY OWNER
6	SURFACE MOUNT BOX	REFER TO FACEPLATE & SURFACE BOX SCHEDULE
9	CAMERA	EXISTING/REFER TO SECURITY CAMERA SCHEDULE
10	WALL CORING	ENSURE CORING IS ANGLED DOWNWARD TOWARD THE EXTERIOR TO HELP PREVENT WATER INFILTRATION.
B	PATCH CORD	REFER TO PATCH CORD SCHEDULE
C	CATEGORY CABLE	REFER TO DATA CABLE SCHEDULE. INCLUDE SERVICE LOOP

PATCH CORD SCHEDULE

COLOR	PURPOSE	MANUFACTURER	PART #	QUANTITY
WHITE	CROSS CONNECT IN TELECOM RM	PANDUIT	UTP28SP1	1 PER INSTALLED CABLE
WHITE	WORKSTATION OR DEVICE	PANDUIT	UTP5P10Y	1 PER INSTALLED CABLE
BLUE	INSTALLED IN PLENUM SPACE	PANDUIT	UPPBU*10	1 PER INSTALLED CABLE

DATA CABLE SCHEDULE

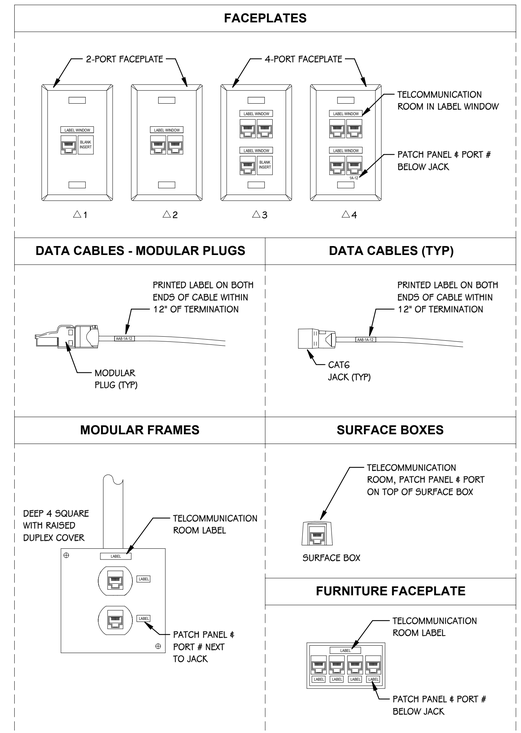
COLOR	PURPOSE	MANUFACTURER	PART #
WHITE	PLENUM CAT6 CABLE	GENERAL CABLE	7131801
WHITE	RISER CAT6 CABLE	GENERAL CABLE	7133801

DATA JACK SCHEDULE

COLOR	PURPOSE	MANUFACTURER	PART #
RED	COPPER BACKBONE	PANDUIT	CJ688TGRD
ORANGE	RESERVED	PANDUIT	CJ688TGOR
YELLOW	WIRELESS ACCESS POINTS	PANDUIT	CJ688TGYL
GREEN	FACILITIES	PANDUIT	CJ688TGGR
BLUE	SPECIAL NETWORK	PANDUIT	CJ688TGBU
VIOLET	SECURITY CAMERAS	PANDUIT	CJ688TGVL
BLACK	RESERVED	PANDUIT	CJ688TGBL
GRAY	POTS LINES	PANDUIT	CJ688TGIG
WHITE	GENERAL DATA & IP PHONES	PANDUIT	CJ688TGWH

FACEPLATE & SURFACE BOX SCHEDULE

COLOR	TYPE	MANUFACTURER	PART #
MATCH ELEC	1-PORT FACEPLATE, SINGLE-GANG	PANDUIT	CFPL1**Y
MATCH ELEC	2-PORT FACEPLATE, SINGLE-GANG	PANDUIT	CFPL2**Y
MATCH ELEC	3-PORT FACEPLATE, SINGLE-GANG	PANDUIT	CFPL3**Y
MATCH ELEC	4-PORT FACEPLATE, SINGLE-GANG	PANDUIT	CFPL4**Y
MATCH ELEC	6-PORT FACEPLATE, SINGLE-GANG	PANDUIT	CFPL6**Y
MATCH ELEC	1-PORT SURFACE BOX	PANDUIT	CBX1IW-A
MATCH ELEC	2-PORT SURFACE BOX	PANDUIT	CBX2IW-AY
MATCH FURNITURE	4-PORT FURNITURE PLATE	PANDUIT	VARIES



TYPICAL LABELING DETAIL

SCALE: NONE

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ADDENDUM #1	02-09-2026
ISSUED FOR	DATE

PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS
OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

DATE
DECEMBER 8, 2025

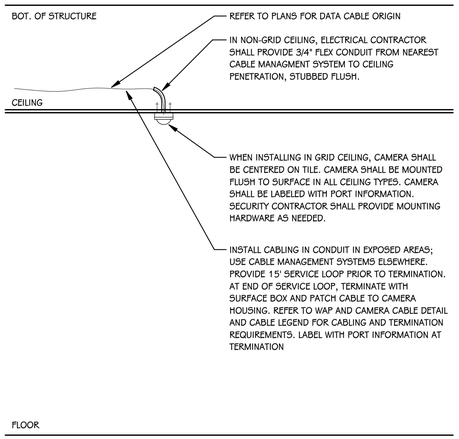
SHEET TITLE
TECHNOLOGY DETAILS

A1

SHEET NUMBER
T 401
23-626.00

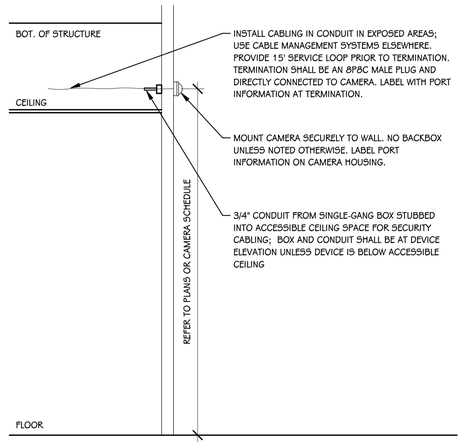
SECURITY CAMERA SCHEDULE

CAMERA NUMBER	MAKE/MODEL	MOUNTING HEIGHT	MOUNTING TYPE	DATA DROPS	COMMENTS
C101	AXIS P3267-LVE		SOFFIT	1	
C102	USE EXISTING CAMERA FROM DEMO	9' - 0"	WALL	1	
C103	AXIS P3267-LV		ACP CEILING	1	



TYPICAL SECURITY CAMERA ROUGH-IN - CEILING

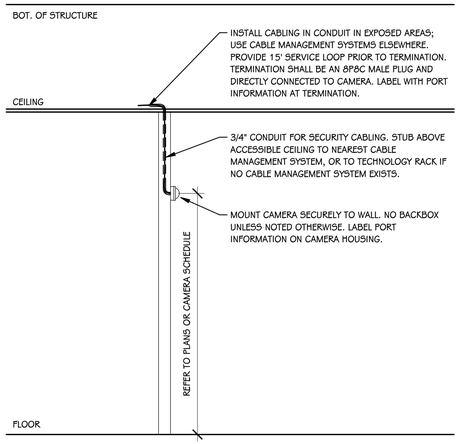
SCALE: NONE



TYPICAL SECURITY CAMERA ROUGH-IN - EXTERIOR WALL

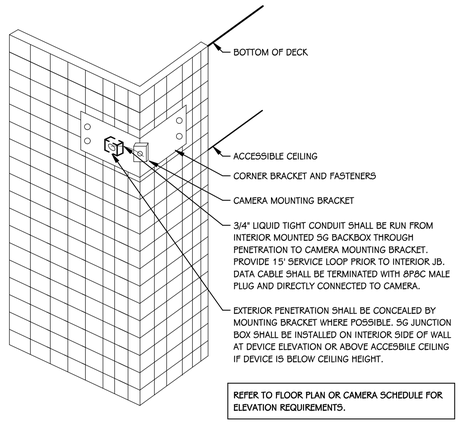
SCALE: NONE

A1



TYPICAL SECURITY CAMERA ROUGH-IN - INTERIOR WALL

SCALE: NONE

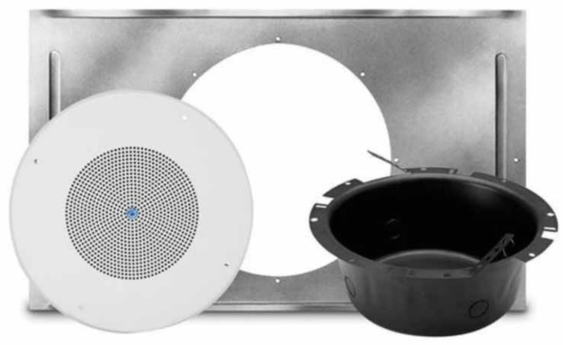


TYPICAL SECURITY CAMERA ROUGH-IN - EXTERIOR CORNER

SCALE: NONE

SHOWN FOR REFERENCE ONLY.

EACH PAGING SPEAKER SHALL BE A NEW SPEAKER, PROVIDED AND INSTALLED BY THE TECHNOLOGY CONTRACTOR AS PART OF A SEPARATE PROJECT.

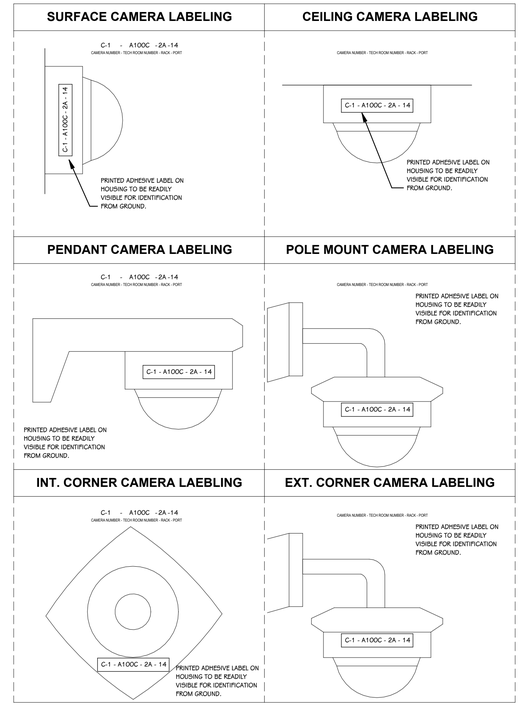


PAGING SPEAKER DETAIL

SCALE: NONE

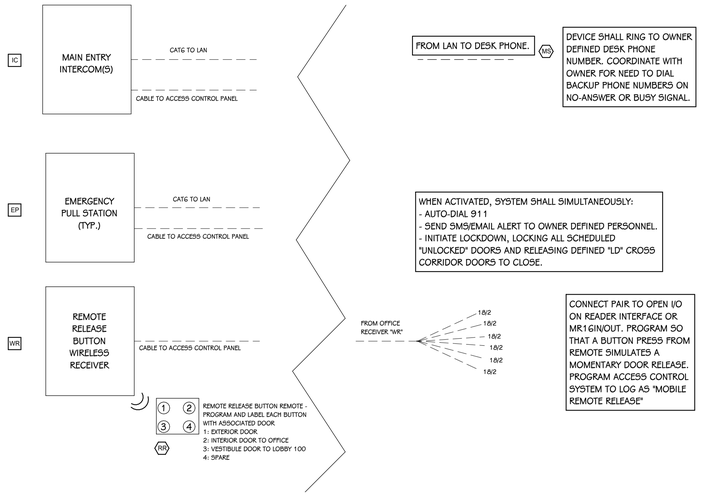
PAGING SPEAKER EQUIPMENT SCHEDULE

KEY #	DESCRIPTION	MANUFACTURER	PART #	COMMENTS
1	PAGING SPEAKER KIT	ATLAS IED	SD72W-KIT	KIT INCLUDES: SPEAKER, BAFFLE, BACK BOX & T-BAR BRIDGE. USE AT ALL CEILING PAGING SPEAKER LOCATIONS.



TYPICAL CAMERA LABELING DETAIL

SCALE: NONE



INTERCOM AND EMERGENCY PULL STATION RISER

SCALE: NONE

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OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS

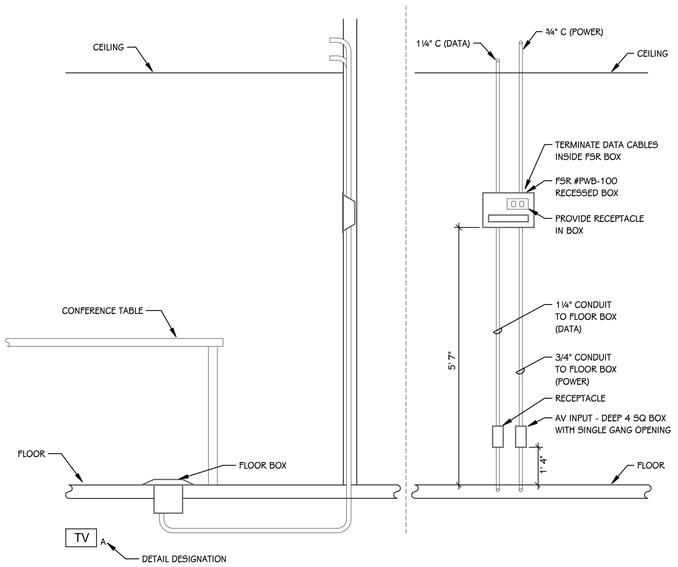
Kalamazoo, Michigan

SHEET TITLE
TECHNOLOGY & CAMERA DETAILS

DATE
DECEMBER 8, 2025

SHEET NUMBER
T 402

23-626.00

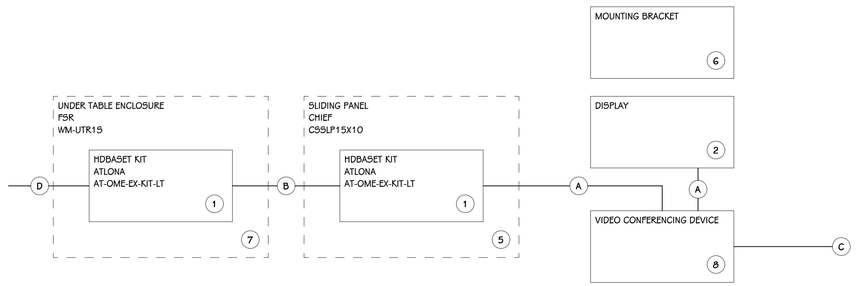


CONFERENCE ROOM AV ROUGH-IN

SCALE: NONE

AV1 EQUIPMENT SCHEDULE				
KEY #	DESCRIPTION	MANUFACTURER	PART #	COMMENTS
1	HDBASET KIT	ATLONA	AT-OME-EX-KIT-LT	
2	DISPLAY			PROVIDED AND INSTALLED BY OWNER AT A LATER DATE
3	VERTICAL PATHWAY	FSR	WM-CP-BCK	
4	UNDER TABLE RACK	FSR	WM-UTR1S	
5	SLIDING PANEL	CHIEF	CSSLP15X10	
6	MOUNTING BRACKET			PROVIDED AND INSTALLED BY OWNER AT A LATER DATE
7	UNDER TABLE ENCLOSURE	FSR	WM-UTR1S	
8	VIDEO CONFERENCING DEVICE			PROVIDED AND INSTALLED BY OWNER AT A LATER DATE
A	HDMI CABLE	KRAMER	C–HM/HM–3	
B	CAT6 BULK CABLE			REFER TO STRUCTURED CABLING EQUIPMENT SCHEDULE
C	LAN CONNECTION			CONNECT TO DATA CABLE BEHIND DISPLAY
D	HDMI CABLE	KRAMER	C–HM/HM–10	

NOTE: ALL RISER DIAGRAMS INDICATE INTENDED SIGNAL FLOW/FUNCTIONALITY. INSTALLER IS RESPONSIBLE FOR INCLUDING ANY/ALL DEVICES, CABLES, ADAPTERS, LICENSES, AND ACCESSORIES TO PROVIDE COMPLETE AND FUNCTIONAL SYSTEMS REGARDLESS OF WHETHER ALL COMPONENTS ARE INDICATED ON PROJECT DRAWINGS.



- TOP OF DISPLAY SHALL BE 78" AFF.
- VIDEO CONFERENCE CAMERA/SPEAKER SHALL BE MOUNTED DIRECTLY BELOW DISPLAY.
- HDBASET RECEIVE SHALL BE INSTALLED ON SLIDING PANEL.
- SLIDING PANEL TO BE MOUNTED DIRECTLY BEHIND THE DISPLAY BUT SHALL BE READILY ACCESSIBLE WITHOUT REMOVING DISPLAY.
- UNDER TABLE ENCLOSURE SHALL BE MOUNTED ON BOTTOM SIDE OF TABLE TOP. COORDINATE FINAL LOCATION WITH OWNER. INSTALL HDBASET TRANSMITTER IN ENCLOSURE.
- AV INSTALLER SHALL DRILL HOLE AND INSTALL GROMMET IN TABLE TOP FOR HDMI CABLE TO ROUTE THROUGH. COORDINATE FINAL LOCATION WITH OWNER.

AV1 RISER DIAGRAM - TYPICAL CLASSROOM

AV1 / T 403

12" = 1'-0"

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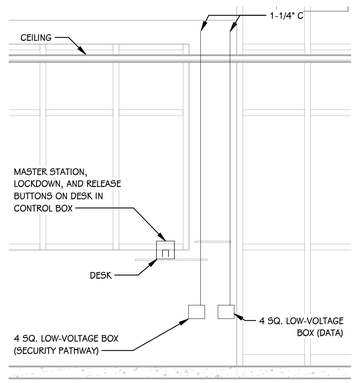
OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

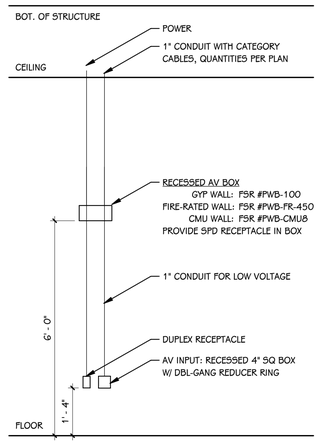
DATE
DECEMBER 8, 2025

SHEET TITLE
AV DETAILS

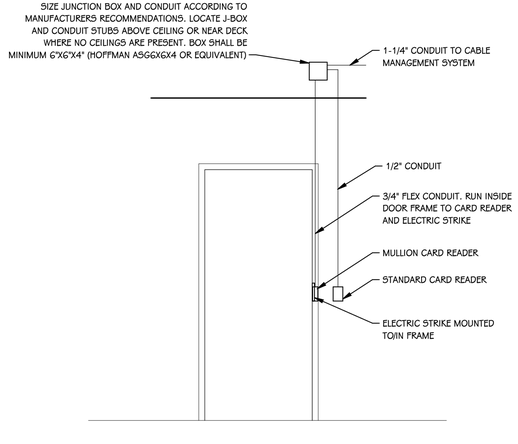
A1
SHEET NUMBER
T 403
23-626.00



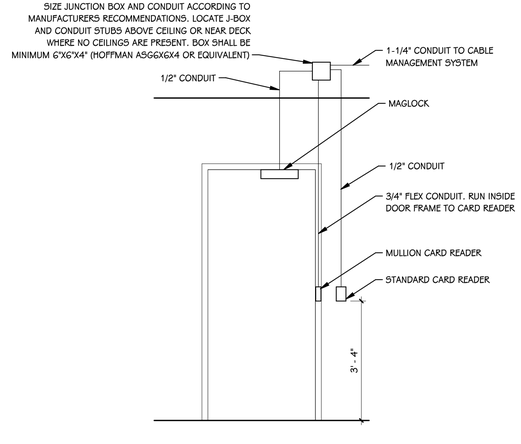
1 / T 404 DESK ELEVATION LV BOX ROUGH-IN - TYP.
1/2" = 1'-0"



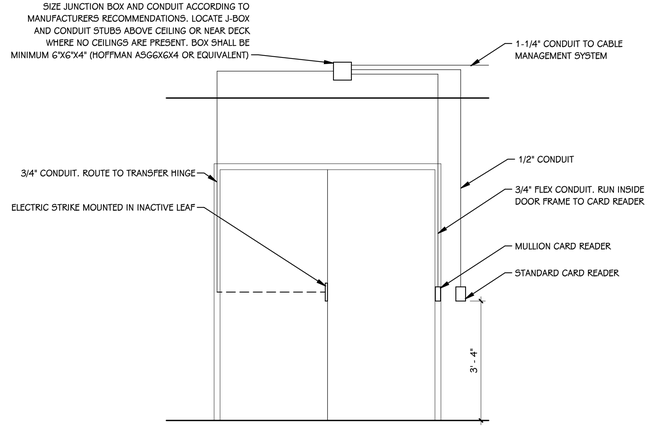
2 / T 404 TELEVISION ROUGH-IN DETAIL - TV-A
1/2" = 1'-0"



1A / T 404 AC SINGLE DOOR WITH STRIKE
1/2" = 1'-0"



1B / T 404 AC SINGLE DOOR WITH MAGLOCK
1/2" = 1'-0"



2H / T 404 AC DOUBLE DOOR WITH STRIKES
1/2" = 1'-0"

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OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

DATE
DECEMBER 8, 2025

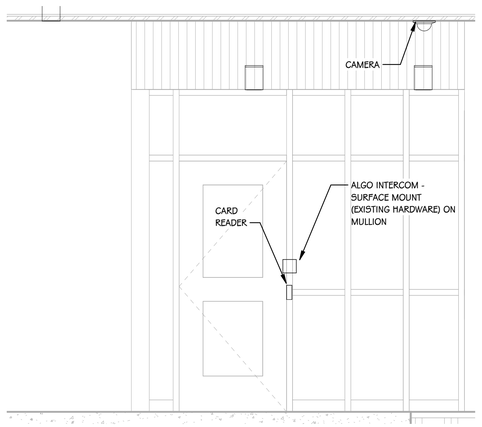
SHEET TITLE
ROUGH-IN DETAILS

SHEET NUMBER
T 404
23-626.00
A1

ACCESS CONTROL DOOR SCHEDULE

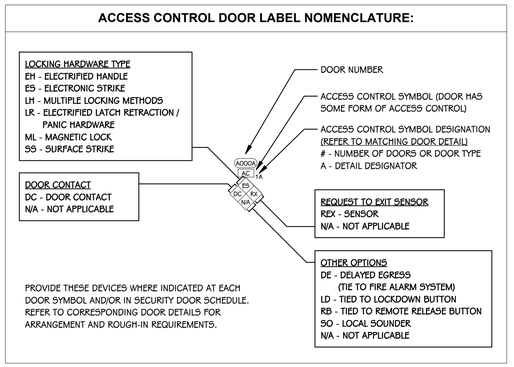
NUMBER	ACCESS CONTROLS	SECURITY INFO			
DOOR	CARD READER	LOCKING HARDWARE TYPE	OTHER	DOOR DETAIL #	PROGRAMMING NOTES
100D	Yes	E5	RB	1A	1, 2, 3, 4, 5
100E	No	ML	RB	1B	1, 3, 5
100F	Yes	E5	RB	1A	1, 2, 3, 5
101	No	ML	RB	1B	1, 3, 5
1001	Yes	E5	N/A	2H	1, 2, 5

PROGRAMMING NOTES LEGEND:
1.) DOOR NORMALLY LOCKED VIA ACCESS CONTROL SYSTEM.
2.) PRESENTATION OF VALID CREDENTIAL TO CARD READER MOMENTARILY UNOCKS ELECTRIFIED HARDWARE AND ALLOWS ACCESS.
3.) UPON ACTIVATION OF RELEASE BUTTON TIED THROUGH THE ACCESS CONTROL SYSTEM, THE ELECTRIFIED HARDWARE MOMENTARILY UNLOCKS AND ALLOWS ACCESS.
4.) UPON ACTIVATION OF RELEASE VIA INTERCOM SYSTEM, A RELAY TO THE ACCESS CONTROL PANEL WILL MOMENTARILY UNLOCK ELECTRIFIED HARDWARE, ALLOWING ACCESS.
5.) DURING THE EVENT OF A LOCKDOWN, ELECTRIFIED HARDWARE REVERTS TO A LOCKED STATE, ONLY ALLOWING THOSE WITH CREDENTIALS TO UNLOCK THE ELECTRIFIED HARDWARE UNTIL LOCKDOWN IS DEACTIVATED.
6.) DOOR NORMALLY UNLOCKED DURING REGULAR HOURS.
7.) DOOR CONTACT FOR MONITORING ONLY.
8.) DOOR NORMALLY LOCKED DURING REGULAR HOURS (MANUAL LOCK).

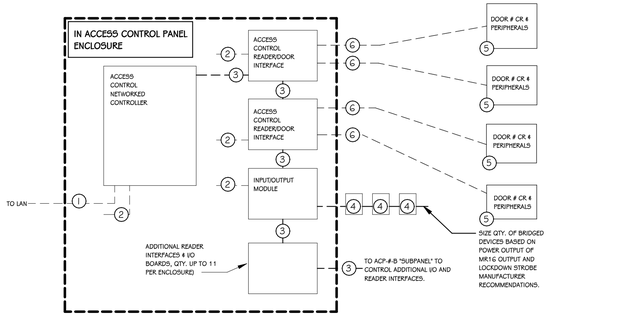


1 / T 441 FRONT INTERCOM & CARD READER
1/2" = 1'-0"

ACCESS CONTROL DOOR LABEL NOMENCLATURE:



PROVIDE THESE DEVICES WHERE INDICATED AT EACH DOOR SYMBOL AND/OR IN SECURITY DOOR SCHEDULE. REFER TO CORRESPONDING DOOR DETAILS FOR ARRANGEMENT AND ROUGH-IN REQUIREMENTS.



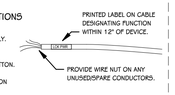
	DEVICE	MANUFACTURER/PART #	NOTES
1	CATEGORY CABLE	SEE SPEC 27 1513	PROVIDED BY CONTRACTOR RESPONSIBLE FOR SECTION 27 1513.
2	18AWG/2C	SEE SECURITY DEVICE AND CABLING CHART	12-24 VDC CONNECTION TO POWER DIST. MODULE/POWER SUPPLY
3	RS-485	BELDEN 82841	PROVIDE RS-485 LOOP TO CONNECT CONTROLLER TO MAX. NUMBER OF SUPPORTED DOWNSTREAM DEVICES.
4	LOCKDOWN DEVICE	SEE SECURITY DEVICE AND CABLING CHART FOR PART #	EXACT LAYOUT AND QTY. OF EACH DEVICE PER MODULE SHALL BE SIZED, CONFIGURED, AND SUPPLIED TO SUPPORT # OF DEVICES ON PLANS.
5	CR, RX, DC, LD, RB, # OTHER CONTROL INTERFACES		
6	MULTICONDUCTOR CABLE		

COORDINATE FAIL-SAFE VS. FAIL-SECURE LOCK CONNECTIONS IN COMPLIANCE WITH FIRE CODE AND COORDINATED WITH PROGRAMMING NOTES ON ACCESS CONTROL SCHEDULE.

ACCESS CONTROL PANEL AND INTERFACE GENERAL WIRING DIAGRAM
SCALE: NONE

AC CABLES AT DEVICE

NAMING CONVENTIONS
LCK POWER - LOCKING HARDWARE/POWER SUPPLY.
REX - REQUEST TO EXIT SENSOR OR MANUAL BUTTON.
DR MNTR - DOOR POSITION SWITCH.
SPARE - SPARE CONDUCTORS



AC CABLES AT PANEL

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LCK POWER - LOCKING HARDWARE/POWER SUPPLY.
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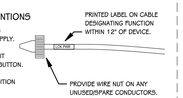
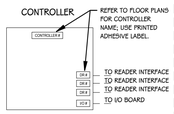
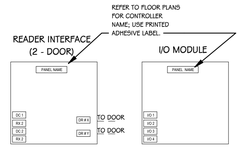
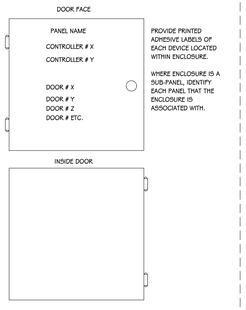


PANEL INTERIOR LABELING

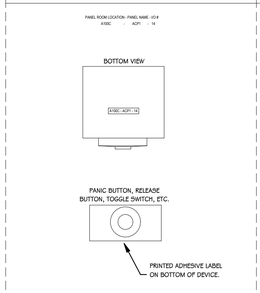




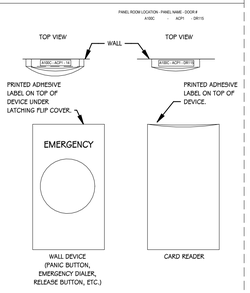
PANEL EXTERIOR LABELING



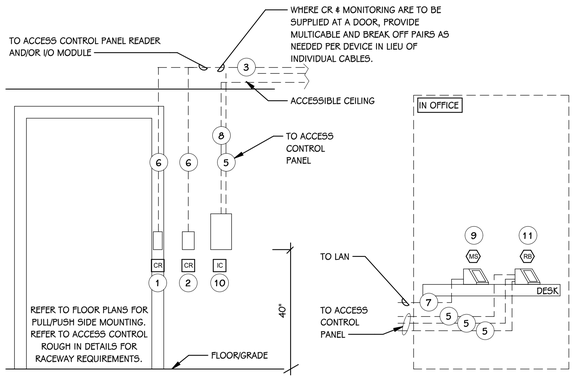
UNDER DESK DEVICE LABELING



WALL DEVICE LABELING



TYPICAL SECURITY DEVICE LABELING DETAIL
SCALE: NONE



SECURITY END OF LINE DEVICE AND CABLING CHART
1/2" = 1'-0"

SECURITY END OF LINE DEVICE & CABLING SCHEDULE

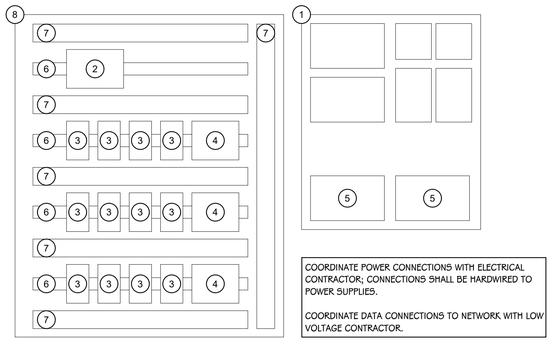
KEY #	DESCRIPTION	MANUFACTURER	PART #	COMMENTS
1	CARD READER - MULLION	HID	SIGNO 20KTS-00-000000	USE WHEN CR SYMBOL IS SHOWN ON MULLION, FRAME, OR OTHER NARROW-WIDTH MOUNTING APPLICATION.
2	CARD READER - STANDARD	HID	SIGNO 40KTS-00-000000	SCHLAGE MTB SERIES ACCEPTABLE EQUIVALENT.
3	CABLE - MULTICABLE	BELDEN	6548AFJ ACCESS CONTROL	USE WHEN DOOR REQUIRES CR AND ANY OTHER DEVICE. OTHERWISE, SEE BELOW CABLES.
5	CABLE - 18/4 AWG/CONDUCTOR	BELDEN	6341FE	UPSIZE CABLE AS REQUIRED TO ELIMINATE SIGNAL LOSS.
6	CABLE - 18/6 AWG/CONDUCTOR	BELDEN	6304FE	UPSIZE CABLE AS REQUIRED TO ELIMINATE SIGNAL LOSS.
7	CABLE - INTERCOM MASTER STATION	SEE CABLE SCHEDULE	CATEGORY CABLE	REFER TO COMMUNICATION CABLE # COMPONENT LEGEND
8	CABLE - INTERCOM DOOR STATION	SEE CABLE SCHEDULE	CATEGORY CABLE	REFER TO COMMUNICATION CABLE # COMPONENT LEGEND
9	DEVICE - INTERCOM MASTER STATION	N/A	OWNER'S DESK PHONE	COORDINATE WITH OWNER TO PROGRAM PHONES FOR INTERCOM DIALING AND DOOR RELEASE THROUGH ACP.
10	DEVICE - INTERCOM DOOR STATION	ALGO 8028	EXISTING	SURFACE MOUNT USING EXISTING HARDWARE ONTO DOOR MULLION
11	DEVICE - DESK MOUNT CONTROLS BOX # SWITCHES	SCHLAGE	8204-MMMM-MS	COORDINATE FINAL LOCATION WITH OWNER AT TIME OF INSTALL. PROVIDE ADHESIVE LABEL OF EACH DOOR TIED TO SPECIFIC RELEASE.

GENERAL NOTES APPLY TO ALL LV CABLE*

- ALL CABLE SHALL BE PLENUM RATED IN PLENUM SPACE.
- CABLES UTILIZING WIEGAND COMMS SHALL NOT EXCEED 500FT TO ACCESS CONTROL PANEL.
- CABLES UTILIZING OSDP SHALL NOT EXCEED 2000FT.
- CABLE SIZING SHALL BE VERIFIED PRIOR TO INSTALLATION AND UPSIZED AS NECESSARY TO ELIMINATE SIGNAL LOSS.
- CABLES SHALL BE RUN IN CONTINUOUS OR NON-CONTINUOUS CABLE MANAGEMENT SYSTEMS. FREE-RUN CABLING IS NOT ACCEPTABLE ANYWHERE. ZIP TIES, ELECTRICAL TAPE, OR OTHER SIMILAR ADHESIVES ARE NOT ACCEPTABLE.
- WHERE IN EXPOSED AREAS (E.G. UNDER DESK, ALONG COUNTERTOP), CABLES SHALL BE RUN IN MESH CABLE SLEEVE (TECHFLEX F6N2.00-25-BLACK, CUT TO SIZE).
- ALL DEVICES THAT CONTROL DOOR HARDWARE SHALL BE CABLED TO INTERFACE THROUGH THE ACCESS CONTROL PLATFORM AND NEVER BE DIRECTLY CONNECTED TO THE LOCK POWER.

*SEE COPPER CABLE DETAIL AND SPECIFICATIONS FOR REQUIREMENTS AND CONDITIONS.

TRIDIUM CONTROL PANEL RISER
SCALE: NONE



COORDINATE POWER CONNECTIONS WITH ELECTRICAL CONTRACTOR; CONNECTIONS SHALL BE HARDWIRED TO POWER SUPPLIES.

COORDINATE DATA CONNECTIONS TO NETWORK WITH LOW VOLTAGE CONTRACTOR.

TRIDIUM EQUIPMENT SCHEDULE

KEY #	DESCRIPTION	MANUFACTURER	PART #	COMMENTS
1	ENCLOSURE, POWER SUPPLIES, POWER DISTRIBUTION MODULES, LOCK POWER	LIFESAFETY POWER	250/250-2C6P2D8PE4	N/A
2	NETWORK CONTROLLER	TRIDIUM	JACE 8000	N/A
3	DOOR CONTROLLER	TRIDIUM	T-SEC-R2R	QUANTITY AS REQUIRED.
4	IO MODULE	TRIDIUM	T-SEC-RIO	QUANTITY AS REQUIRED.
5	BATTERY ENCLOSURE	TRIDIUM	MFR RECOMMENDED. SEALED LEAD ACID OR GEL TYPE.	SIZE BATTERY FOR SIX HOURS OF OPERATION.
6	DIN RAIL	N/A	N/A	N/A
7	WIRE MANAGEMENT	PANDUIT	F2X2LG6	N/A
8	DEVICE ENCLOSURE	LIFESAFETY POWER	E8L	N/A

ACCESS CONTROL NOTES:
- ALL TIMES LISTED BELOW ARE APPROXIMATES; FINAL PROGRAMMED TIMES SHALL BE COORDINATED WITH OWNER.

- COORDINATE DOOR UNLOCK AND LOCK SCHEDULE WITH OWNER. AT MINIMUM, PROVIDE SCHEDULED UNLOCK FOR THE FOLLOWING:
  - NORMAL SCHOOL START (E.G. 7:30AM-8:00AM UNLOCK)
  - DELAYED SCHOOL START (E.G. TWO HOUR DELAY)
  - HALF DAY SCHEDULE
  - NON-SCHOOL DAY
  - EVENT PROGRAMMING x3 (E.G. THREE SEPARATE EVENT TEMPLATES THE OWNER MAY DESIRE, SUCH AS A BASKETBALL OR VOLLEYBALL GAME).
  - LOCKDOWN (OVERRIDES ALL SCHEDULES, SETS ALL DOORS TO LOCKED, AND RESTRICTS CARD ACCESS TO AN "EXECUTIVE PRIVILEGE" ROLE – E.G. SCHOOL RESOURCE OFFICER, DISTRICT ADMIN, AND OTHERS THE OWNER DEEMS ACCEPTABLE.

- REFER TO DRAWINGS FOR CARD READER LOCATIONS, DOORS REQUIRING READ IN/READ OUT CREDENTIALING REQUIREMENTS.

- REFER TO ELECTRICAL DRAWINGS AND COORDINATE WITH ELECTRICAL CONTRACTOR FOR SEQUENCING ACCESS CONTROL SYSTEM WITH AUTOMATIC DOOR OPERATORS. DOORS WITH AUTOMATIC OPERATORS SHALL NOT OPERATE UNLESS THE ACCESS CONTROL PLATFORM HAS SET THE DOOR TO "UNLOCKED", OR AN APPROPRIATE ACCESS CREDENTIAL HAS BEEN PRESENTED.

- REFER TO ELECTRICAL DRAWINGS AND COORDINATE WITH FIRE ALARM CONTRACTOR FOR ALL DOORS REQUIRING INTERFACE WITH FIRE ALARM, E.G. DOORS NOTED TO FAIL SAFE UPON SMOKE/FLOW ACTIVATION. MANUAL FIRE PULL STATIONS SHALL NOT UNLOCK ANY DOORS.

- REFER TO ELECTRICAL DRAWINGS AND COORDINATE WITH FIRE ALARM CONTRACTOR FOR REQUIRED RELAYS TO RELEASE MAGNETICALLY HELD DOORS UPON ACTIVATION OF LOCKDOWN.

- REFER TO ARCHITECTURAL DOOR SCHEDULE AND SPECIFICATION SECTION 08 "DOOR HARDWARE" FOR COORDINATING LOCK POWER FOR ELECTRIFIED HARDWARE (I.E. ELECTRIC STRIKES, LATCH RETRACTION, ELECTRIFIED TRIM/HANDLE, MAGLOCKS, ETC.), INCLUDING QUANTITY OF ELECTRIFIED HARDWARE PER DOOR. PROVIDE ADEQUATE POWER SUPPLIES TO POWER ELECTRIFIED HARDWARE ASSOCIATED WITH EACH ACCESS CONTROL PANEL AT FULL CAPACITY (E.G. IF ACP-2B IS ONLY DESIGNED TO INTERFACE WITH 4 DOORS BUT CAN BE SIZED TO 12, PROVIDE ENOUGH POWER SUPPLY CAPACITY TO POWER ADDITIONAL 8 DOORS).

- ALL ACCESS CONTROL WORK DONE PERTAINING TO ELEVATORS SHALL BE COORDINATED WITH THE ELEVATOR CONTRACTOR FOR CODE COMPLIANCE AND INTERFACE WITH ELEVATOR CONTROLLER.

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ADDENDUM #1 02-09-2026
ISSUED FOR DATE

PROJECT TITLE
MAPLE STREET MAGNET SCHOOL FOR THE ARTS
OFFICE RENOTATION - SECURE VESTIBULE & OFFICE

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

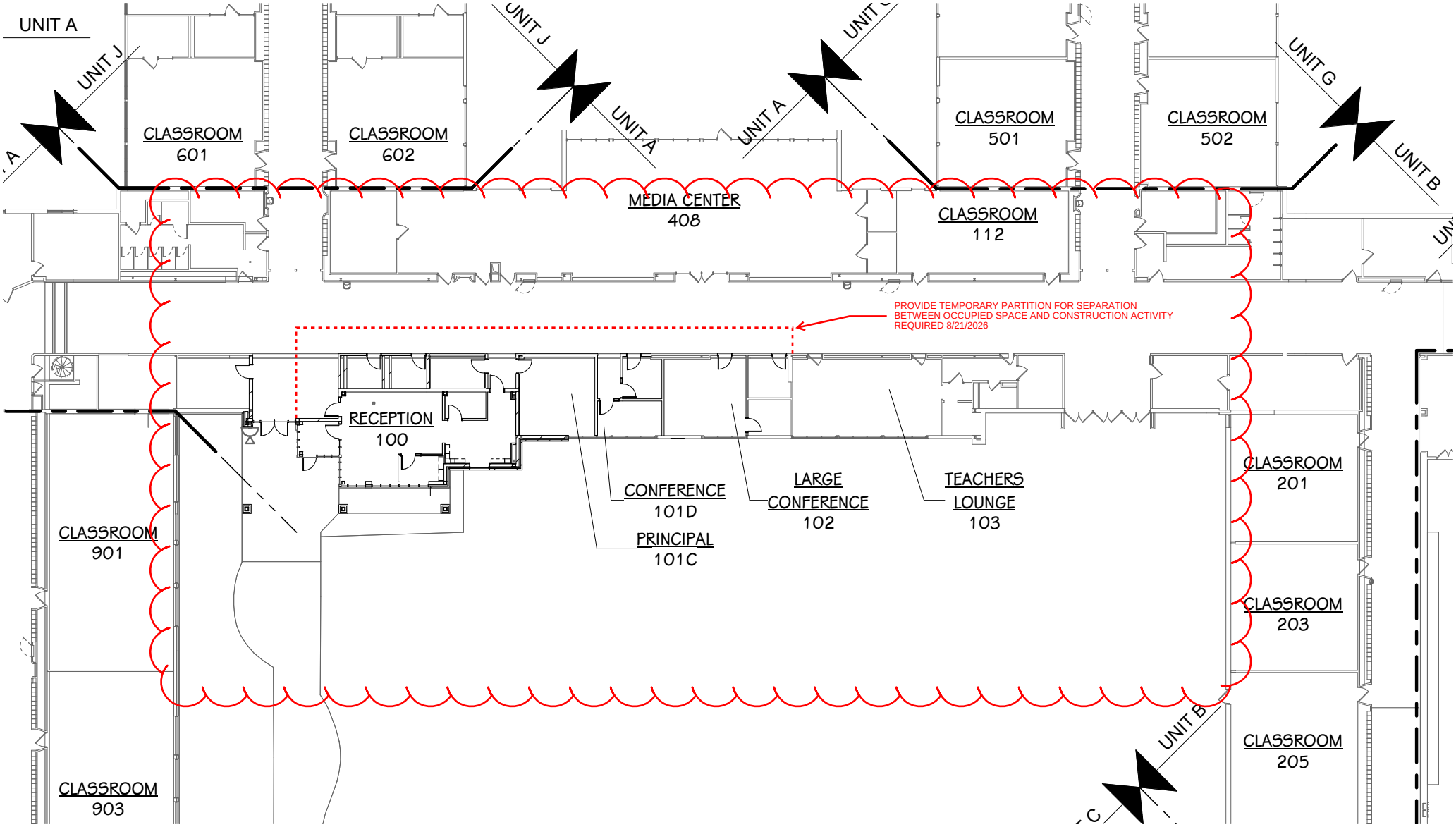
DATE
DECEMBER 8, 2025

SHEET TITLE
ACCESS CONTROL DETAILS

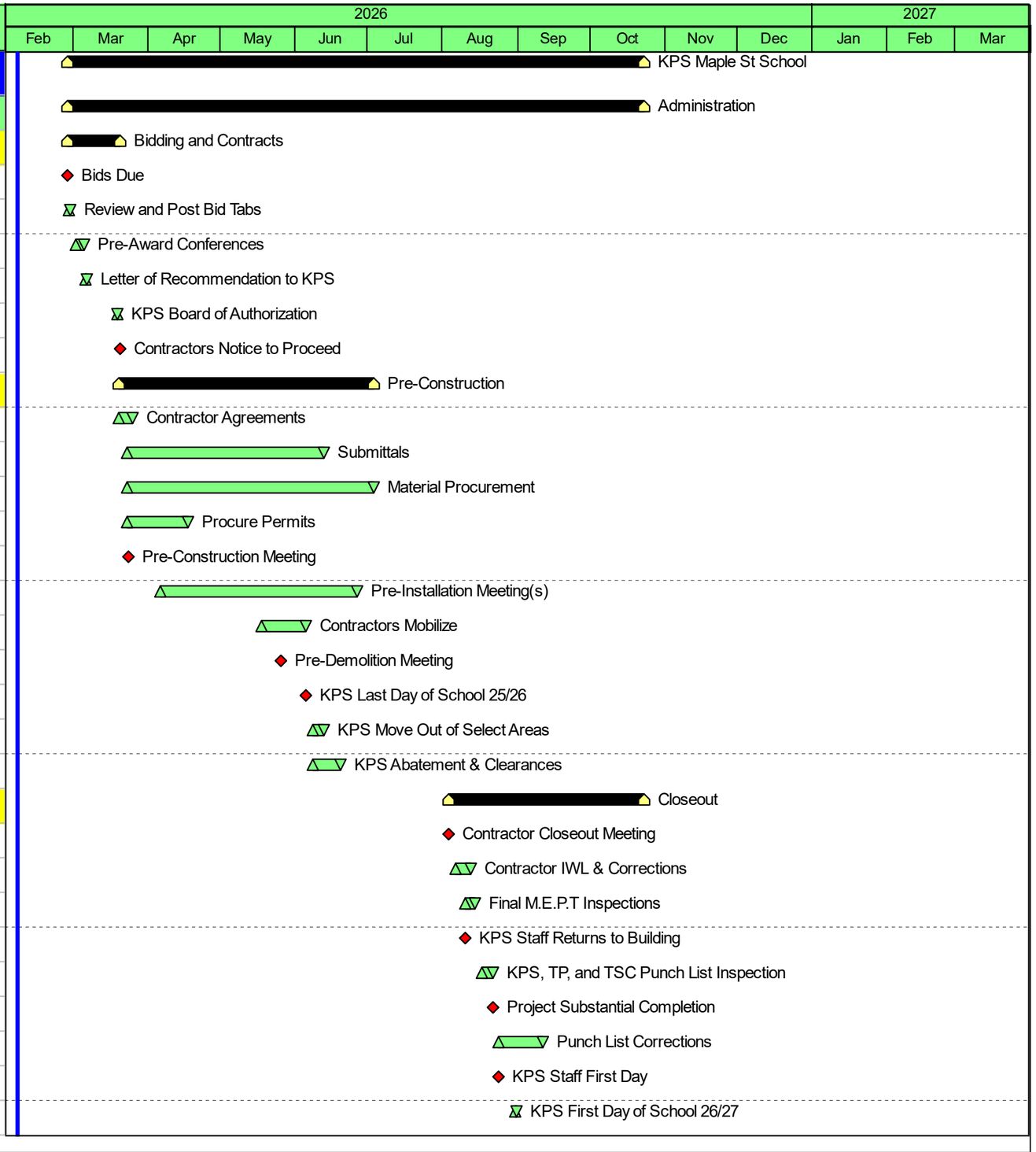
SHEET NUMBER
T 441
23-626.00

2/9/2026

TEMPORARY PARTITION PLAN



Activity Name	Original Duration	Start	Finish
KPS Maple St School	171	26-Feb-26	23-Oct-26
Administration	171	26-Feb-26	23-Oct-26
Bidding and Contracts	16	26-Feb-26	20-Mar-26
Bids Due	0		26-Feb-26
Review and Post Bid Tabs	1	27-Feb-26	27-Feb-26
Pre-Award Conferences	4	02-Mar-26	05-Mar-26
Letter of Recommendation to KPS	1	06-Mar-26	06-Mar-26
KPS Board of Authorization	1	19-Mar-26	19-Mar-26
Contractors Notice to Proceed	0		20-Mar-26
Pre-Construction	76	20-Mar-26	03-Jul-26
Contractor Agreements	4	20-Mar-26	25-Mar-26
Submittals	60	23-Mar-26	12-Jun-26
Material Procurement	75	23-Mar-26	03-Jul-26
Procure Permits	20	23-Mar-26	17-Apr-26
Pre-Construction Meeting	0	24-Mar-26	
Pre-Installation Meeting(s)	60	06-Apr-26	26-Jun-26
Contractors Mobilize	15	18-May-26	05-Jun-26
Pre-Demolition Meeting	0	26-May-26	
KPS Last Day of School 25/26	0		05-Jun-26
KPS Move Out of Select Areas	5	08-Jun-26	12-Jun-26
KPS Abatement & Clearances	10	08-Jun-26	19-Jun-26
Closeout	59	03-Aug-26	23-Oct-26
Contractor Closeout Meeting	0		03-Aug-26
Contractor IWL & Corrections	5	06-Aug-26	12-Aug-26
Final M.E.P.T Inspections	5	10-Aug-26	14-Aug-26
KPS Staff Returns to Building	0	10-Aug-26	
KPS, TP, and TSC Punch List Inspection	5	17-Aug-26	21-Aug-26
Project Substantial Completion	0		21-Aug-26
Punch List Corrections	15	24-Aug-26	11-Sep-26
KPS Staff First Day	0	24-Aug-26	
KPS First Day of School 26/27	1	31-Aug-26	31-Aug-26

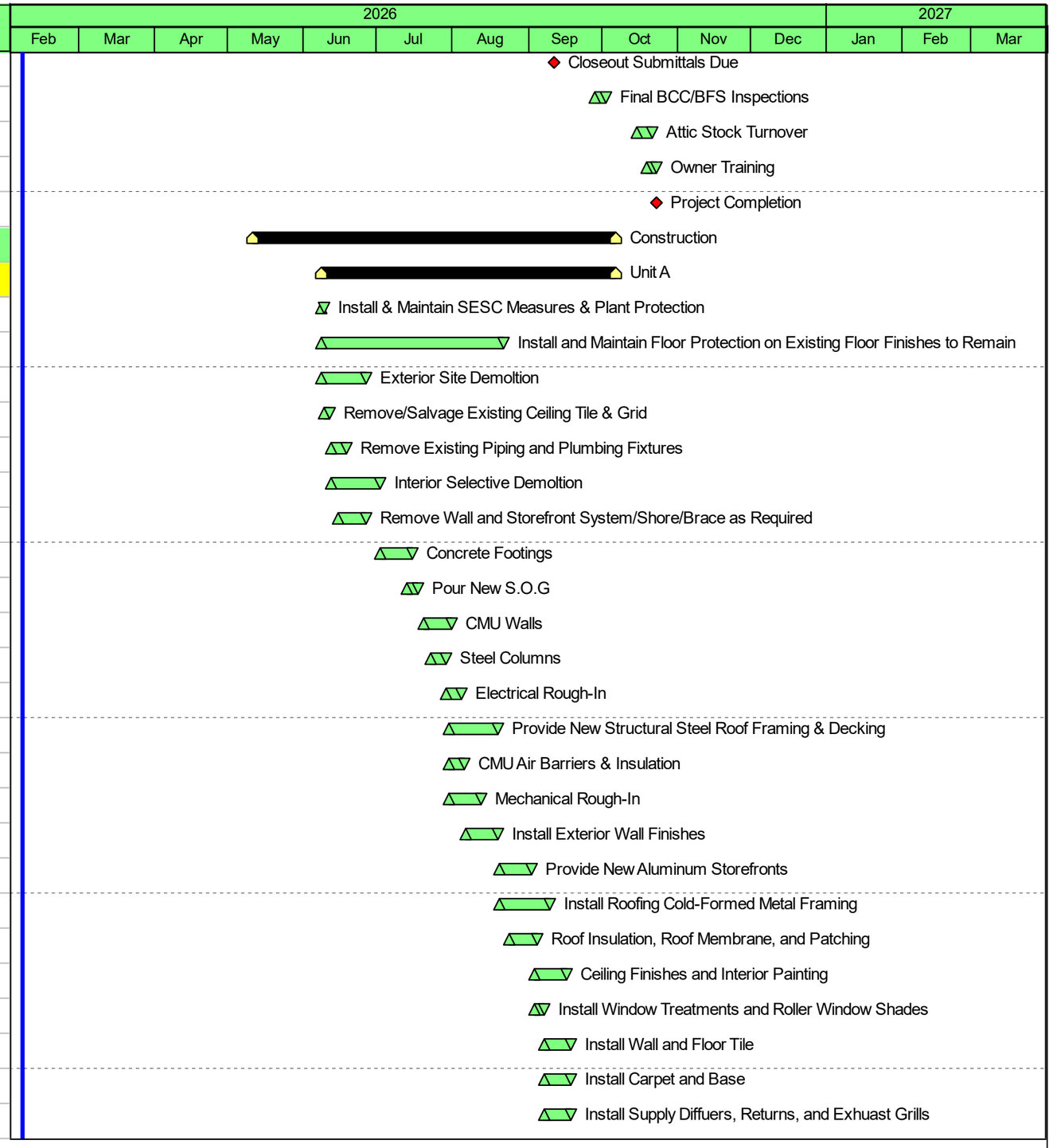


Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

224010.10 KPS Maple St School
Guideline Schedule - 6-February-26
1 of 3

SKILLMAN

Activity Name	Original Duration	Start	Finish
Closeout Submittals Due	0		11-Sep-26
Final BCC/BFS Inspections	5	28-Sep-26	02-Oct-26
Attic Stock Turnover	5	15-Oct-26	21-Oct-26
Owner Training	5	19-Oct-26	23-Oct-26
Project Completion	0		23-Oct-26
Construction	107	11-May-26	06-Oct-26
Unit A	87	08-Jun-26	06-Oct-26
Install & Maintain SESC Measures & Plant Protection	2	08-Jun-26	09-Jun-26
Install and Maintain Floor Protection on Existing Floor Finishes to Remain	55	08-Jun-26	21-Aug-26
Exterior Site Demoltion	15	08-Jun-26	26-Jun-26
Remove/Salvage Existing Ceiling Tile & Grid	3	09-Jun-26	11-Jun-26
Remove Existing Piping and Plumbing Fixtures	5	12-Jun-26	18-Jun-26
Interior Selective Demoltion	15	12-Jun-26	02-Jul-26
Remove Wall and Storefront System/Shore/Brace as Required	10	15-Jun-26	26-Jun-26
Concrete Footings	10	02-Jul-26	15-Jul-26
Pour New S.O.G	5	13-Jul-26	17-Jul-26
CMU Walls	10	20-Jul-26	31-Jul-26
Steel Columns	5	23-Jul-26	29-Jul-26
Electrical Rough-In	5	29-Jul-26	04-Aug-26
Provide New Structural Steel Roof Framing & Decking	15	30-Jul-26	19-Aug-26
CMU Air Barriers & Insulation	5	30-Jul-26	05-Aug-26
Mechanical Rough-In	10	30-Jul-26	12-Aug-26
Install Exterior Wall Finishes	10	06-Aug-26	19-Aug-26
Provide New Aluminum Storefronts	10	20-Aug-26	02-Sep-26
Install Roofing Cold-Formed Metal Framing	15	20-Aug-26	09-Sep-26
Roof Insulation, Roof Membrane, and Patching	10	24-Aug-26	04-Sep-26
Ceiling Finishes and Interior Painting	10	03-Sep-26	16-Sep-26
Install Window Treatments and Roller Window Shades	3	03-Sep-26	07-Sep-26
Install Wall and Floor Tile	10	07-Sep-26	18-Sep-26
Install Carpet and Base	10	07-Sep-26	18-Sep-26
Install Supply Diffuers, Returns, and Exhuast Grills	10	07-Sep-26	18-Sep-26



Actual Work
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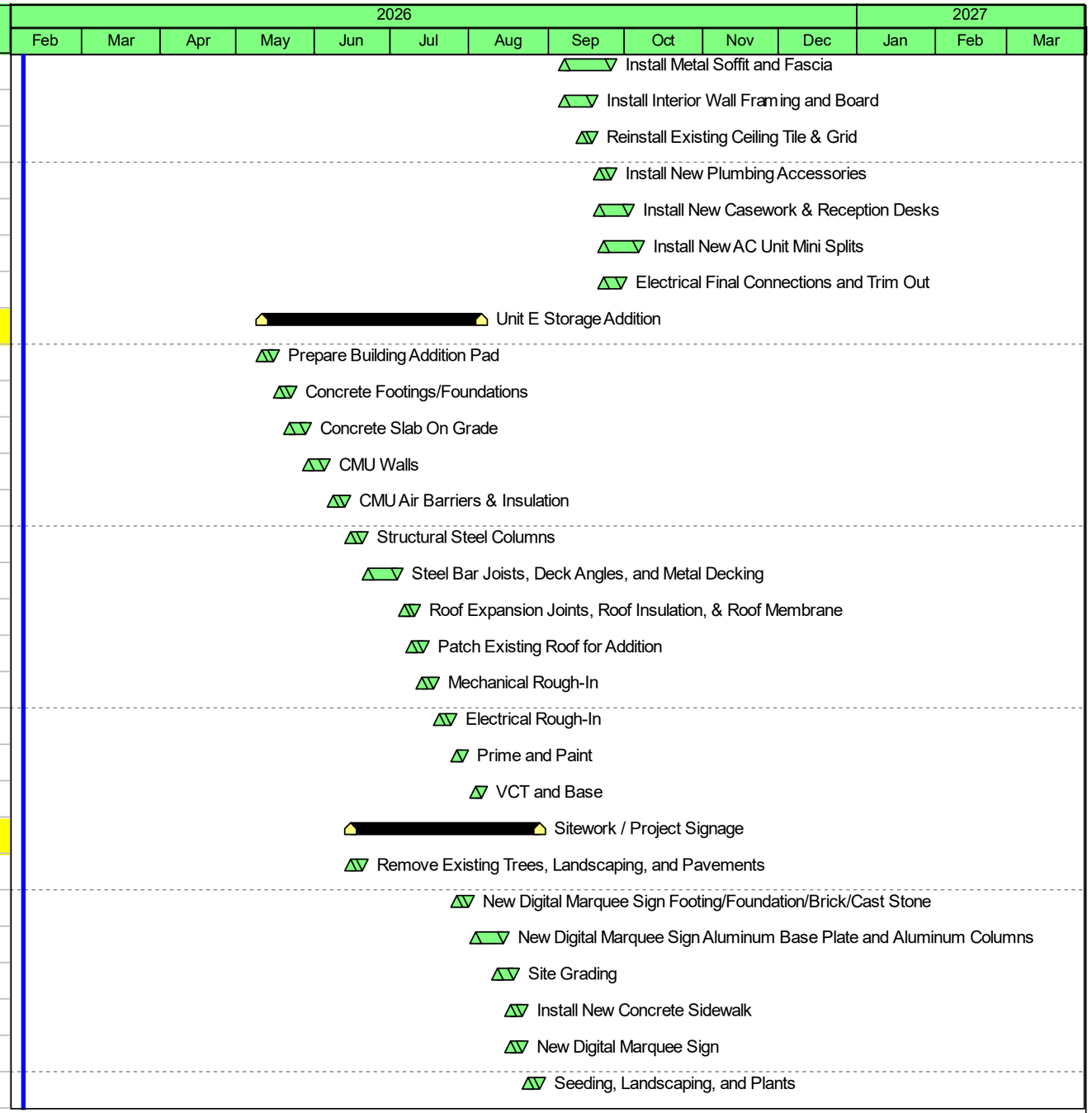
224010.10 KPS Maple St School
Guideline Schedule - 6-February-26
2 of 3

SKILLMAN

Activity Name	Original Duration	Start	Finish
Install Metal Soffit and Fascia	15	07-Sep-26	25-Sep-26
Install Interior Wall Framing and Board	10	07-Sep-26	18-Sep-26
Reinstall Existing Ceiling Tile & Grid	5	14-Sep-26	18-Sep-26
Install New Plumbing Accessories	5	21-Sep-26	25-Sep-26
Install New Casework & Reception Desks	10	21-Sep-26	02-Oct-26
Install New AC Unit Mini Splits	10	23-Sep-26	06-Oct-26
Electrical Final Connections and Trim Out	5	23-Sep-26	29-Sep-26
Unit E Storage Addition	63	11-May-26	05-Aug-26
Prepare Building Addition Pad	5	11-May-26	15-May-26
Concrete Footings/Foundations	5	18-May-26	22-May-26
Concrete Slab On Grade	5	22-May-26	28-May-26
CMU Walls	5	29-May-26	04-Jun-26
CMU Air Barriers & Insulation	5	08-Jun-26	12-Jun-26
Structural Steel Columns	5	15-Jun-26	19-Jun-26
Steel Bar Joists, Deck Angles, and Metal Decking	10	22-Jun-26	03-Jul-26
Roof Expansion Joints, Roof Insulation, & Roof Membrane	5	06-Jul-26	10-Jul-26
Patch Existing Roof for Addition	3	09-Jul-26	13-Jul-26
Mechanical Rough-In	5	13-Jul-26	17-Jul-26
Electrical Rough-In	5	20-Jul-26	24-Jul-26
Prime and Paint	3	27-Jul-26	29-Jul-26
VCT and Base	3	03-Aug-26	05-Aug-26
Sitework / Project Signage	55	15-Jun-26	28-Aug-26
Remove Existing Trees, Landscaping, and Pavements	5	15-Jun-26	19-Jun-26
New Digital Marquee Sign Footing/Foundation/Brick/Cast Stone	5	27-Jul-26	31-Jul-26
New Digital Marquee Sign Aluminum Base Plate and Aluminum Columns	10	03-Aug-26	14-Aug-26
Site Grading	5	12-Aug-26	18-Aug-26
Install New Concrete Sidewalk	5	17-Aug-26	21-Aug-26
New Digital Marquee Sign	5	17-Aug-26	21-Aug-26
Seeding, Landscaping, and Plants	5	24-Aug-26	28-Aug-26



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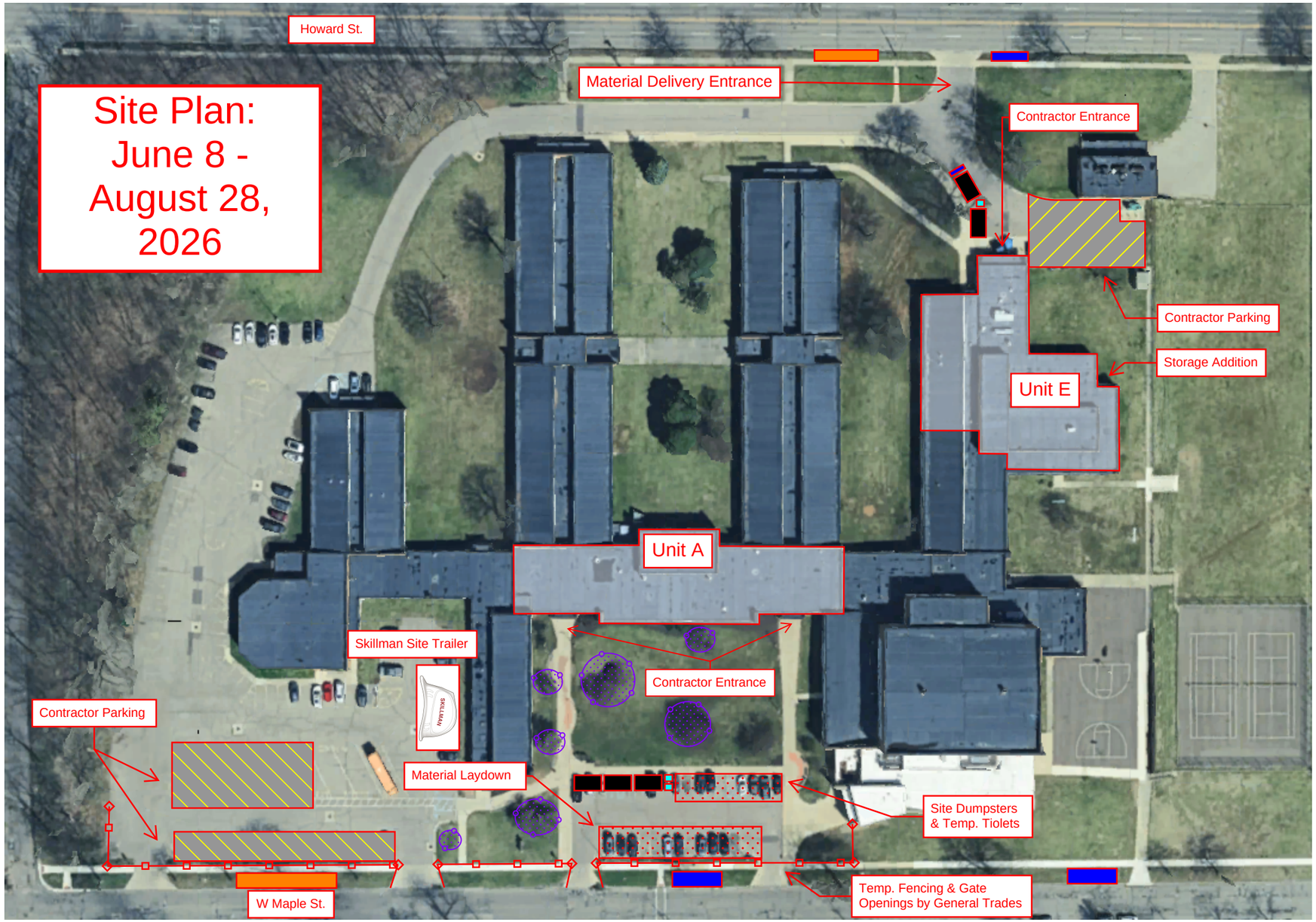
224010.10 KPS Maple St School
Guideline Schedule - 6-February-26
3 of 3

SKILLMAN

Kalamazoo Public Schools

MAPLE STREET SCHOOL



LEGEND:

Material Laydown Area =

Temp. Tree Protection =

Skillman Site Trailer =

Contractor Parking Area =

Dumpsters =

Large Project Sign =

Project Traffic and
Contractor Entrance Signage =

Temporary Toilets =

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Site Logistics Plan - 2/6/26

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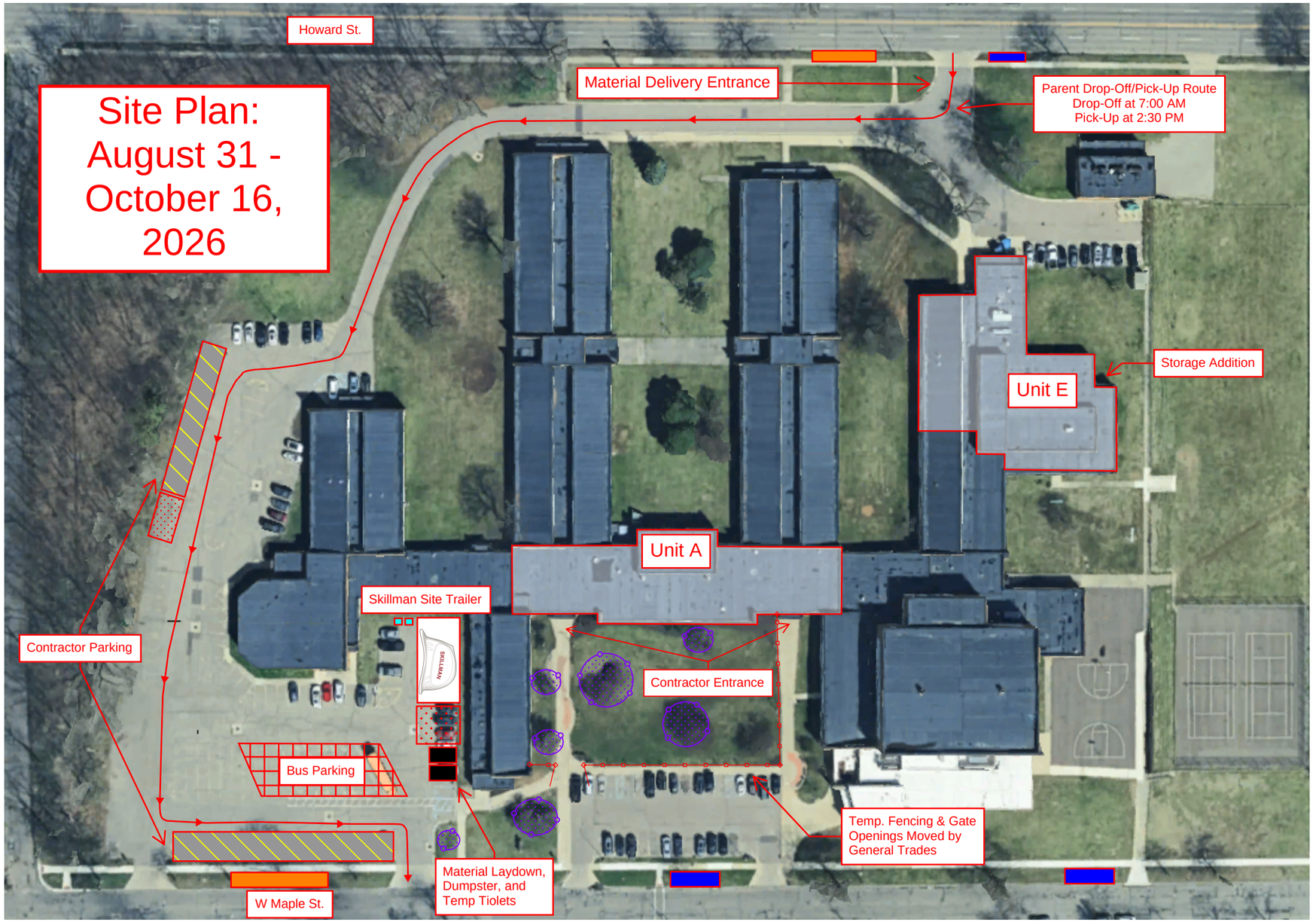
MAPLE STREET SCHOOL



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