

ADDENDUM 01

Addendum #	01	Date Issued	10/30/2024
Project Name Job #	PAUL BUNYAN COMMUNICATIONS CHILLER ADDITION		20231251
Bid Date Time	November 07, 2024		02:00pm (CST)

THIS ADDENDUM AMENDS AND BECOMES PART OF THE CONTRACT DOCUMENTS FOR EAPC PROJECT 20231251 DATED 10/17/2024, RESPECTIVELY. EACH BIDDER SHALL ACKNOWLEDGE RECEIPT OF THIS ADDENDUM BY MARKING THE ADDENDUM NUMBER AND DATE ON THE BID FORM.

SPECIFICATIONS

Shop drawings for all equipment and material designated as “American Made” and “American Sourced” shall include a document confirming that this criteria is met.

20 0719	HVAC PIPING INSULATION	Replace original specification section with attached.
23 2113	HYDRONIC PIPING	Add the attached specification

DRAWINGS

M100C	BASEMENT FLOOR HYDRONIC DEMOLITION PLAN	1. Added demolition of hot water coils and associated piping.
M200C	BASEMENT FLOOR HYDRONIC PLAN	1. Added installation of owner provided hot water coils.
M801C	MECHANICAL SCHEDULES & DETAILS	1. Added Hot Water Coil Detail 2. Updated Cooling Coil Performance.

ATTACHMENTS**DRAWINGS**

M100C

M200C

M801C

SPECIFICATIONS

20 0719 HVAC PIPING INSULATION

23 2113 HYDRONIC PIPING

End of Addendum 1

SECTION 20 0719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. ALL INSULATION MATERIALS WILL MEET “BUY AMERICA GUIDELINES”.**

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Domestic cold water piping.
 - 2. Domestic hot water piping.
 - 3. Domestic recirculating hot water piping.
 - 4. Roof drains and rainwater leaders.
 - 5. Condensate drain piping (copper), indoors and outdoors.
 - 6. Chilled-water piping, indoors and outdoors.
 - 7. Heating hot-water piping, indoors.
- B. Related Sections:
 - 1. Section 20 0716 "Equipment Insulation."
 - 2. Section 23 0713 "Duct Insulation."

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. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A 117.1.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 20 0529 "Hangers and Supports for Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, 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 and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Pittsburgh Corning Corporation.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- F. Exterior chilled water rigid preformed pipe closed-cell insulation shall be Extruded Polystyrene or Polyisocyanurate Insulation as manufactured by ITW Insulation Systems or approved equal.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroflex USA, Inc.
 - 2. Armacell LLC.
 - 3. Armstrong, Inc.
 - 4. CertainTeed Corp.; SoftTouch Duct Wrap.
 - 5. Johns Manville; Microlite.
 - 6. Knauf Insulation; Friendly Feel Duct Wrap.
 - 7. Owens Corning; SOFTR All-Service Duct Wrap.
- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I.
- J. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville; a Berkshire Hathaway company.
 - 3. Knauf Insulation.
 - 4. Owens Corning.
- K. Mineral-Fiber, Preformed Pipe Insulation:
- L. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johns Manville; a Berkshire Hathaway company.
2. Knauf Insulation.
3. Owens Corning.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 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, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 3. Solids Content: 60 percent by volume and 66 percent by weight.
 4. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
 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 (Minus 73 to plus 149 deg C).
 4. Color: White or gray.

5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

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

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

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: 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, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

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 (75 mm).
 2. Thickness: 11.5 mils (0.29 mm).
 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 (75 mm).
 2. Thickness: 6.5 mils (0.16 mm).
 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 (50 mm).
 2. Thickness: 6 mils (0.15 mm).
 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches (50 mm).
 2. Thickness: 3.7 mils (0.093 mm).
 3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 4. Elongation: 5 percent.
 5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

- A. Bands:
1. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy, 0.062-inch (1.6-mm) soft-annealed, stainless steel or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

2.10 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:

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

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

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.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm) o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

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

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

3.4 PENETRATIONS

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

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

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

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

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

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, 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. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:

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

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

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 (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, 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 (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.9 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as per OSHA standards. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

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

3.11 PIPING INSULATION SCHEDULE, GENERAL

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

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Service: Domestic hot, recirculated and cold water.

1. Operating Temperature: 35 to 140 deg F (2 to 60 deg C).
2. Insulation Material: Mineral-fiber preformed pipe.
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, all sizes 1" thick.
4. Vapor Retarder Required: Yes.

- B. Service: Storm Water Piping Above Grade.

1. Operating Temperature: -30 to 100 deg F (-34.4 to 37.8 deg C).
2. Insulation Material: Mineral-fiber preformed pipe.
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. All Pipe Sizes, 1" thick.
4. Vapor Retarder Required: Yes.

- C. Service: Indoor Hydronic Chilled water.

1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Mineral-fiber preformed pipe.
3. Insulation Thickness: Apply the following insulation thickness:
 - a. Pipe Sizes 1.5" and less, 1" thick.
 - b. Pipe Sizes 2" and larger, 1-1/2" thick.

4. Vapor Retarder Required: Yes.

D. Service: Exterior Hydronic Chilled water.

1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Closed cell preformed pipe (polystyrene or polyisocyanurate).
3. Insulation Thickness: Apply the following insulation thickness:
 - a. Pipe Sizes 1.5" and less, 1" thick.
 - b. Pipe Sizes 2" and larger, 1-1/2" thick.
4. Vapor Retarder Required: Yes.
5. Field Applied Jacket: Aluminum mill finish.

E. Service: Indoor Hydronic hot water.

1. Operating Temperature: 60 to 180 deg F.
2. Insulation Material: Mineral-fiber preformed pipe.
3. Insulation Thickness: Apply the following insulation thickness:
 - a. Pipe Sizes 1.5" and less, 1-1/2" thick.
 - b. Pipe Sizes 2" and larger, 2" thick.
4. Vapor Retarder Required: Yes.

END OF SECTION 20 0719

SECTION 23 2113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Air-vent piping.
4. Safety-valve-inlet and -outlet piping.

B. ALL STEEL PIPING AND FITTINGS MATERIALS WILL BE DOMESTICALLY SOURCED AND ALL MANUFACTURING WILL MEET "BUY AMERICA GUIDELINES".

1.2 Delegated-Design Submittal:

A. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

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 Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought Cast- and Forged-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. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer and conform to local code approval. Grooving tools shall be of the same manufacturer as the grooved components. Products are permitted and/or Listed/Approved by codes or standards organizations including but not limited to: ASME (B31.1, 31.9), ASTM, ANSI/AWWA (C-606), FM, IAPMO, International Code Council (IPC, IMC, IFC), NFPA, NSF, UL, ULC, and VdS. Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products, Inc.
 - b. Victaulic Company.
 - 3. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 4. Couplings shall be cast of ductile iron conforming to ASTM A-395, Grade 65-45-15, and/or ASTM A-536, Grade 65-45-12.
 - 5. Mechanical couplings shall consist of two ductile iron housing segments, pressure responsive elastomer gasket (grade suited to the intended service), and zinc-electroplated steel bolts and nuts.

6. Rigid Type: Rigid couplings shall be bolt type, and shall provide system support and hanging requirements in accordance with ANSI B31.1, ANSI B31.9 and NFPA 13.
 - a. 2” through 8” : Grade EPDM gasket suitable for temperatures to +230 degrees F
7. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Noise and vibration reduction at mechanical equipment connections is achieved by installing three flexible couplings near the vibrations source.
8. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.3 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts; a Watts Water Technologies company.
 - b. Zurn Industries, LLC.
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F .
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot Water and Chilled Water, **NPS 1** and Smaller: Aboveground exposed in Mechanical room and at terminal heating and cooling devices only, use **Type L (Type B)** drawn-temper copper tubing with soldered joints, or Schedule 40 steel pipe with threaded joints. All main hydronic heating piping shall be Schedule 40 steel pipe.
- B. Hot Water and Chilled Water, **NPS 1-1/4 to NPS 2**: Aboveground exposed in Mechanical room and at terminal heating and cooling devices only, use **Type L (Type B)** drawn-temper copper tubing with soldered joints, or Schedule 40 steel pipe with threaded joints. All main hydronic heating piping shall be Schedule 40 steel pipe.
- C. Hot Water and Chilled Water, **NPS 2-1/2** and Larger: Use schedule 40 steel pipe with welded and flanged joints, or grooved mechanical-joint couplings.
- D. Condensate-Drain Piping: Type L (Type B) drawn-temper copper tubing with soldered joints.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 ball 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 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 Section 200523 "Valves"
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.

- T. Comply with requirements in Section 200516 "Expansion Fittings and Loops for Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 200553 "Identification" for identifying piping.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 200517 "Sleeves and Sleeve Seals for Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 200517 "Sleeves and Sleeve Seals for Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 200518 "Escutcheons for Piping."
- Y. Install expansion loops and expansion systems on hydronic piping to comply with the requirements in section 20 0516 "Expansion Fittings and Loops for Piping"

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 : Use dielectric flanges or nipples.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 200529 "Hangers and Supports for Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 200548 "Vibration Controls".
- 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.
 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 3/4: Maximum span, 7 feet.
 2. NPS 1: Maximum span, 7 feet.

3. NPS 1-1/2: Maximum span, 9 feet.
 4. NPS 2: Maximum span, 10 feet.
 5. NPS 2-1/2: Maximum span, 11 feet.
 6. NPS 3 and Larger: Maximum span, 12 feet.
- E. 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 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- G. 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/A5.8M.
- 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. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 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 bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 200519 "Meters and Gages for Piping."

3.7 CHEMICAL TREATMENT

- A. See section 23 2513 "Water Treatment for Closed-Loop Hydronic Systems".

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 the "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 operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 2113

GENERAL DEMO NOTES

1. CONTRACTOR TO COORDINATE ANY SYSTEM SHUTDOWNS WITH THE OWNER BEFORE ANY WORK IS COMPLETED.
2. CONTRACTOR TO PERFORM DEMOLITION WORK IN A MANNER TO PRESERVE AS MUCH HYDRONIC SYSTEM FLUID AS POSSIBLE.

KEYNOTE LEGEND:

- <<< INDICATES KEYNOTE ON PLAN
- MD 01 DISCONNECT, REMOVE & DISPOSE OF EXISTING REFRIGERATION LINE SETS TO EXISTING CONDENSING UNITS ON ROOF. MECHANICAL CONTRACTOR TO PATCH ANY BUILDING PENETRATIONS WITH LIKE MATERIALS AIR & WATER TIGHT. FIELD VERIFY EXACT SIZE & LOCATION.
- MD 02 DISCONNECT, REMOVE AND DISPOSE OF EXISTING DX COOLING COIL AND ASSOCIATED PIPING. PREPARE EXISTING AIR HANDLING UNIT FOR INSTALLATION OF NEW FILLED WATER COOLING COIL.
- MD 03 DISCONNECT, REMOVE AND DISPOSE OF EXISTING AIR HANDLING UNIT HEATING COIL AND ASSOCIATED PIPING BACK TO THE SHUTOFF VALVES. PREPARE REMAINING PIPING AND AIR HANDLING UNIT FOR INSTALLATION OF NEW HEATING COIL.



Architecture Engineering
Interior Design Industrial
TELE 218.751.0151 FAX 218.751.0170
222 Third Street NW, Bemidji MN 56601
www.eapc.net

CLIENT
PAUL BUNYAN COMMUNICATIONS

PROJECT DESCRIPTION
CHILLER ADDITION

CITY **BEMIDJI**
STATE **MINNESOTA**

ISSUE DATES

1	ADDENDUM 01	10/30/2024
CD	CONSTRUCTION DOCUMENTS	10/16/2024
MARK	DESCRIPTION	DATE

PROJECT NO: **20231251**
DRAWN BY: **AS**
CHECKED BY: **TB**

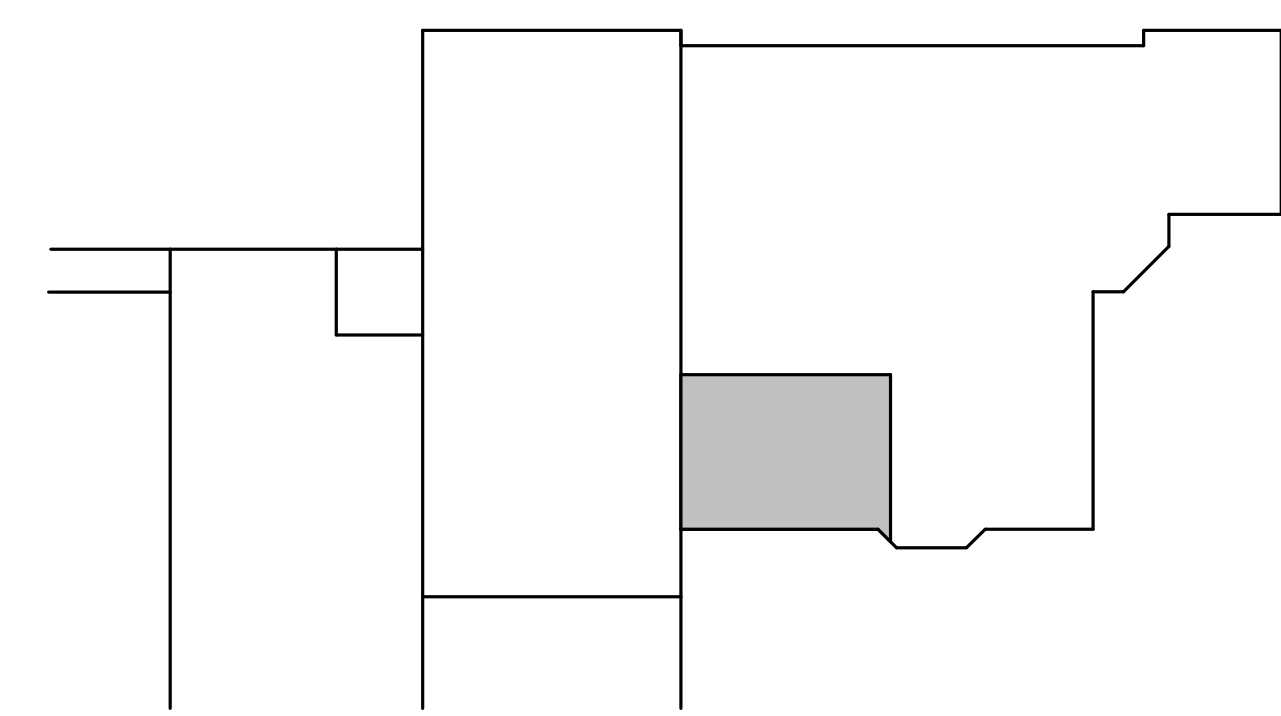
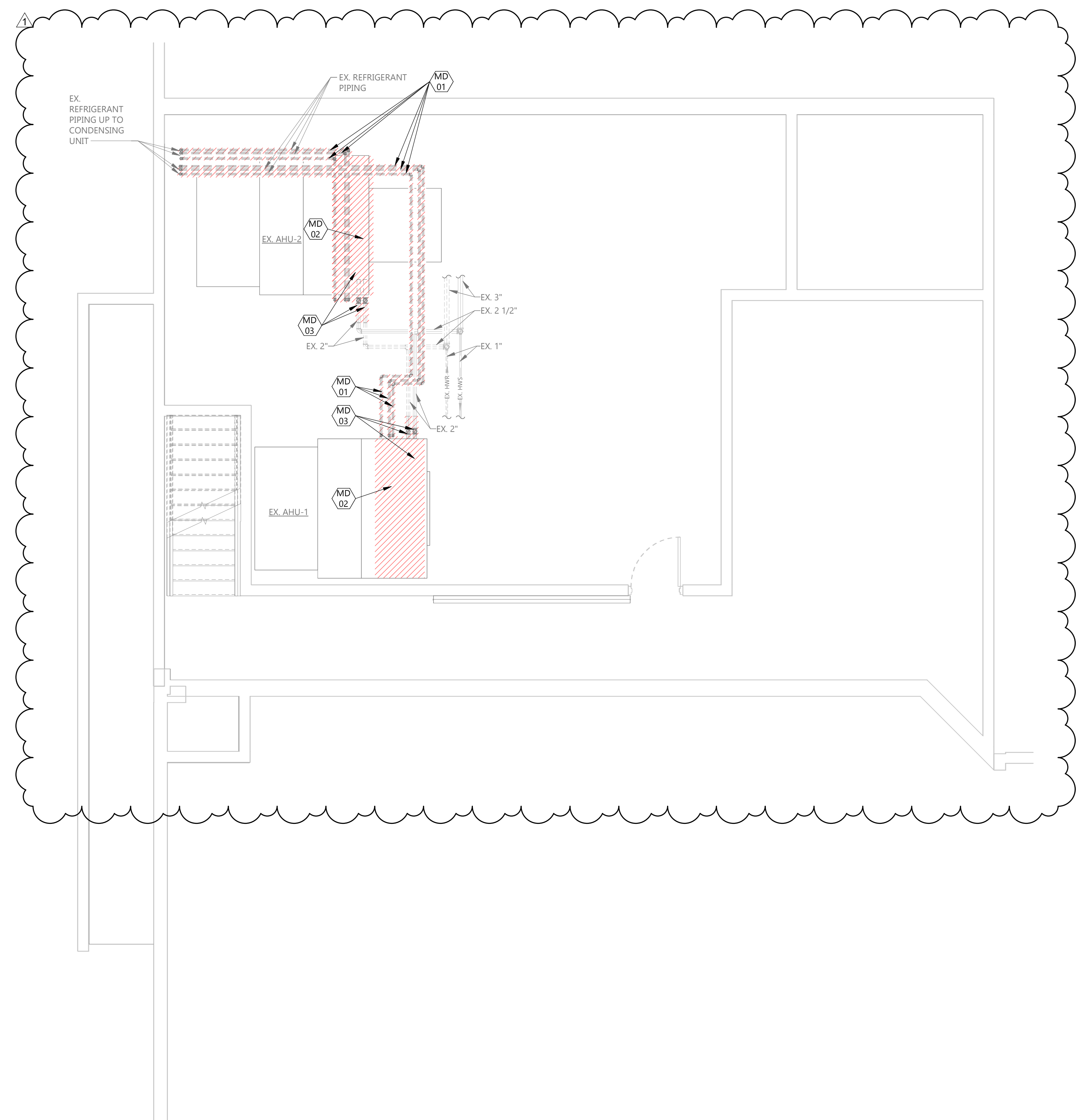
COPYRIGHT:
All plans, specifications, computer files, field data, notes and other documents and instruments prepared by EAPC as instruments of service shall remain the property of EAPC. EAPC shall retain all common law, statutory and other reserved rights, including the copyright there to.

STAMP

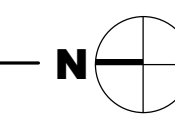
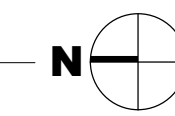
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.
Print Name: **TRENTON BOVITZ**
Signature: *Trenton Bovitz*
Date: 10/30/2024 License #: 57172

DRAWING TITLE
BASEMENT FLOOR HYDRONIC DEMOLITION PLAN

M100C



1 BASEMENT FLOOR HYDRONIC DEMOLITION PLAN
M100C 1/4" = 1'-0"



GENERAL NOTES

1. ROUTE ALL PIPING AS HIGH AS POSSIBLE COORDINATE WITH ALL DISCIPLINES FOR NEAT & ORDERLY INSTALLATION.
2. CONTRACTOR TO VERIFY EXISTING AHU COIL SPACE DIMENSIONS & CONNECTIONS PERIOD TO ORDER THE COIL.

KEYNOTE LEGEND:

- <<< INDICATES KEYNOTE ON PLAN
- MP 01 PROVIDE NEW COOLING COILS (CC-1, CC-2) INSIDE EXISTING AIR HANDLING UNITS (AHU-1 AND AHU-2). PROVIDE ALL NECESSARY SUPPORTS FOR SECURE INSTALLATION. CONNECT NEW CHWS/R LINES WITH THE NECESSARY ISOLATION VALVES, CONTROL VALVES, SENSORS, ETC. ACCORDING TO DETAIL #2/M801C. INTEGRATE COOLING COILS WITH EXISTING AHU CONTROLS, ENSURE ALL ARE INTEGRATED WITH THE BAS. FIELD VERIFY ALL DIMENSIONS AND CONDITIONS BEFORE COMMENCING INSTALLATION. COORDINATE ANY HVAC SHUT-DOWNS DURING INSTALLATION WITH FACILITIES. ROUTE 1" CONDENSATE FROM DRAIN PAN TO FLOOR DRAIN IN ROOM.
- MP 02 PROVIDE NEW CHWS/R PIPING FROM NEW CH-1, MATERIAL TO BE SCHEDULE 40 STEEL, INSULATED WITH 1-1/2" MINERAL FIBER PREFORMED PIPE INSULATION.
- MP 03 INSTALL OWNER PROVIDED HOT WATER HEATING COIL INSIDE EXISTING AIR HANDLING UNITS (AHU-1 AND AHU-2). PROVIDE ALL NECESSARY SUPPORTS FOR SECURE INSTALLATION. EXTEND NEW HWS/R LINES WITH THE NECESSARY VALVES, CONTROL VALVES, SENSORS, ETC. ACCORDING TO DETAIL 3/M801C. INTEGRATE HEATING COILS WITH EXISTING AHU CONTROLS, ENSURE ALL ARE INTEGRATED WITH THE BAS. FIELD VERIFY ALL DIMENSIONS AND CONDITIONS BEFORE COMMENCING INSTALLATION. COORDINATE ANY HVAC SHUT-DOWNS DURING INSTALLATION WITH FACILITIES. FLUSH AND FILL NEW WORK WITH 50% ETHYLENE GLYCOL MIXTURE.

CLIENT
PAUL BUNYAN COMMUNICATIONS

PROJECT DESCRIPTION
CHILLER ADDITION

CITY BEMIDJI
STATE MINNESOTA

ISSUE DATES

1	ADDENDUM 01	10/30/2024
CD	CONSTRUCTION DOCUMENTS	10/16/2024
MARK	DESCRIPTION	DATE

PROJECT NO: 20231251
DRAWN BY: AS
CHECKED BY: TB

COPYRIGHT:
All plans, specifications, computer files, field data, notes and other documents and instruments prepared by EAPC as instruments of service shall remain the property of EAPC. EAPC shall retain all common law, statutory and other reserved rights, including the copyright there to.

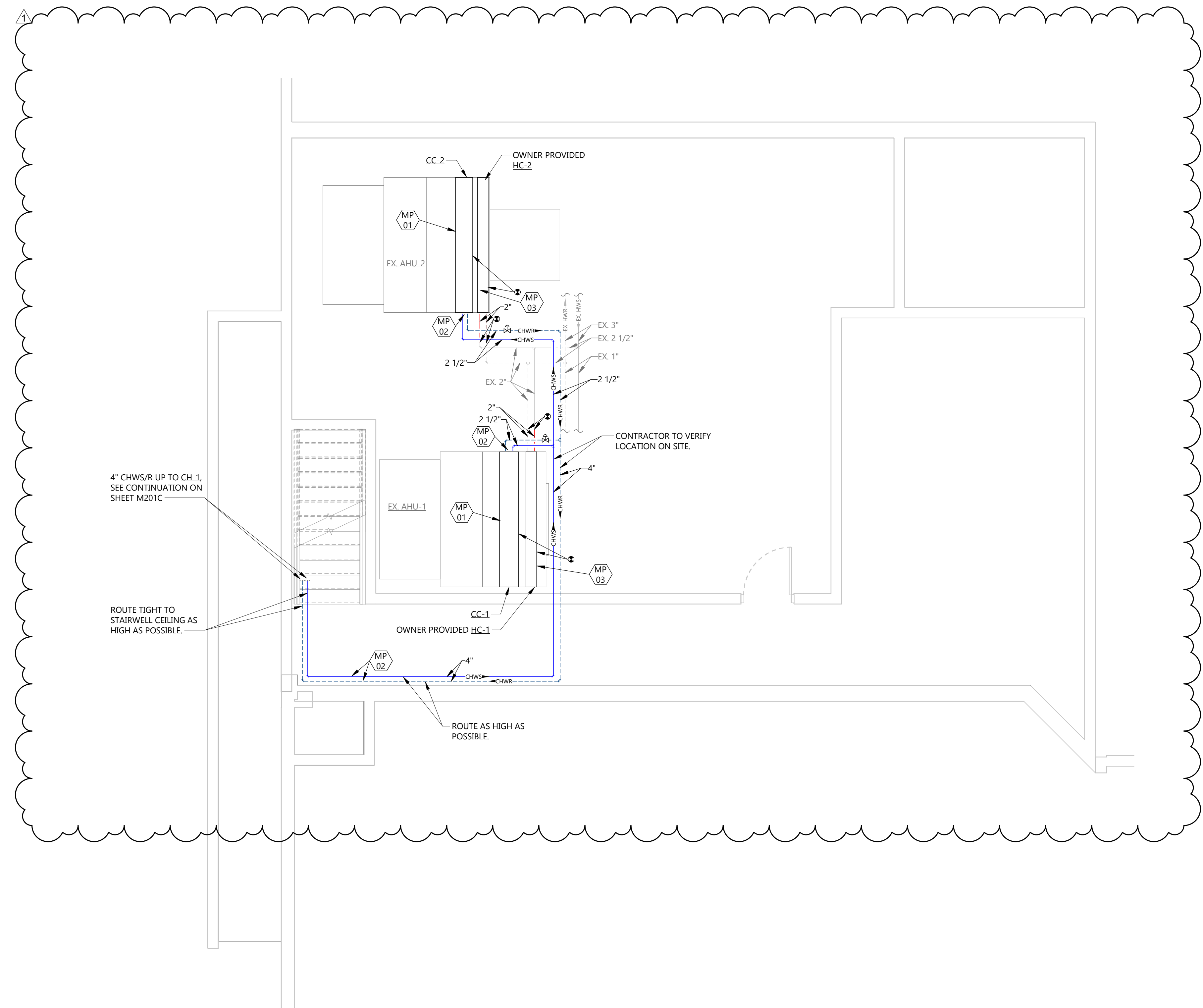
STAMP

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: TRENTON BOVITZ
Signature: Trenton Bovitz
Date: 10/30/2024 License #: 57172

DRAWING TITLE
BASEMENT FLOOR HYDRONIC PLAN

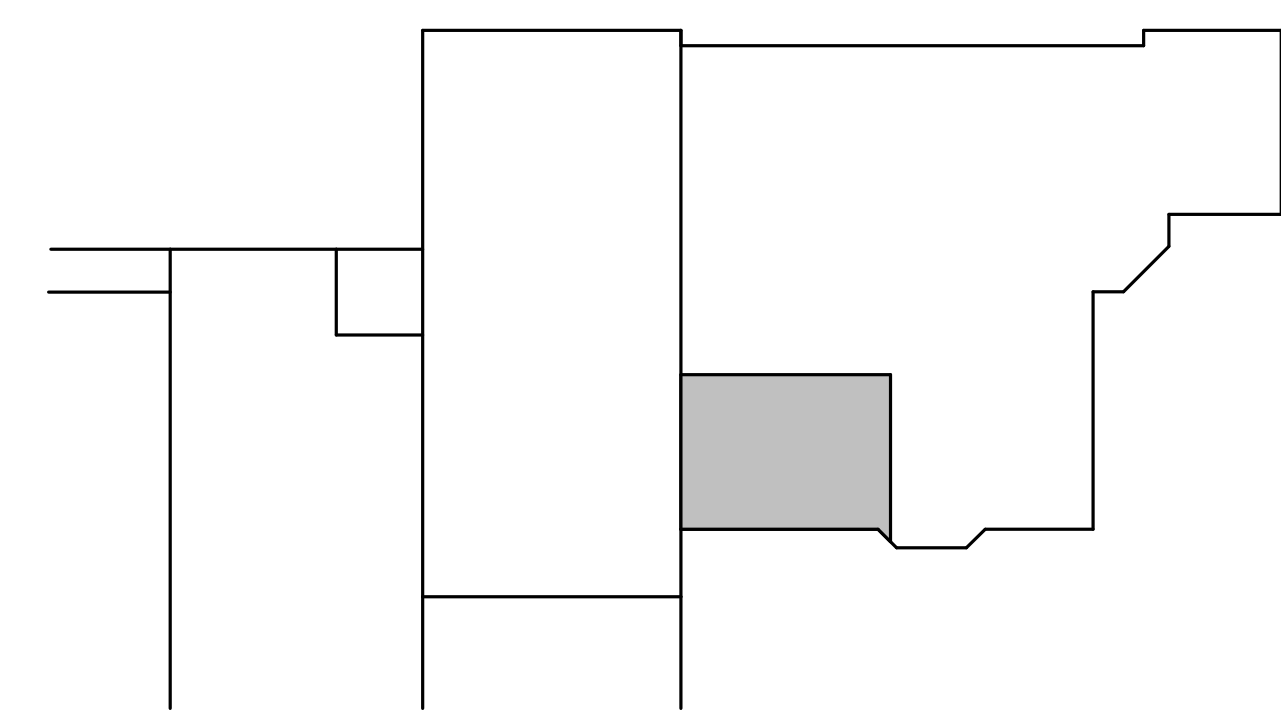
M200C



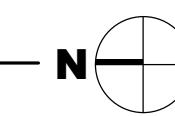
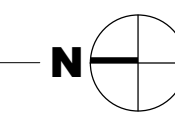
4" CHWS/R UP TO CH-1
SEE CONTINUATION ON
SHEET M201C

ROUTE TIGHT TO
STAIRWELL CEILING AS
HIGH AS POSSIBLE.

ROUTE AS HIGH AS
POSSIBLE.



KEY PLAN



1	ADDENDUM 01	10/30/2024
CD	CONSTRUCTION DOCUMENTS	10/16/2024
MARK	DESCRIPTION	DATE

PROJECT NO: 20231251

DRAWN BY: AS

CHECKED BY: TB

COPYRIGHT:
All plans, specifications, computer files, field data, notes and other documents and instruments prepared by EAPC as instruments of service shall remain the property of EAPC. EAPC shall retain all common law, statutory and other reserved rights, including the copyright there to.

STAMP

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: TRENTON BOVITZ
Signature: Trenton Bovitz
Date: 10/30/2024 License #: 57172

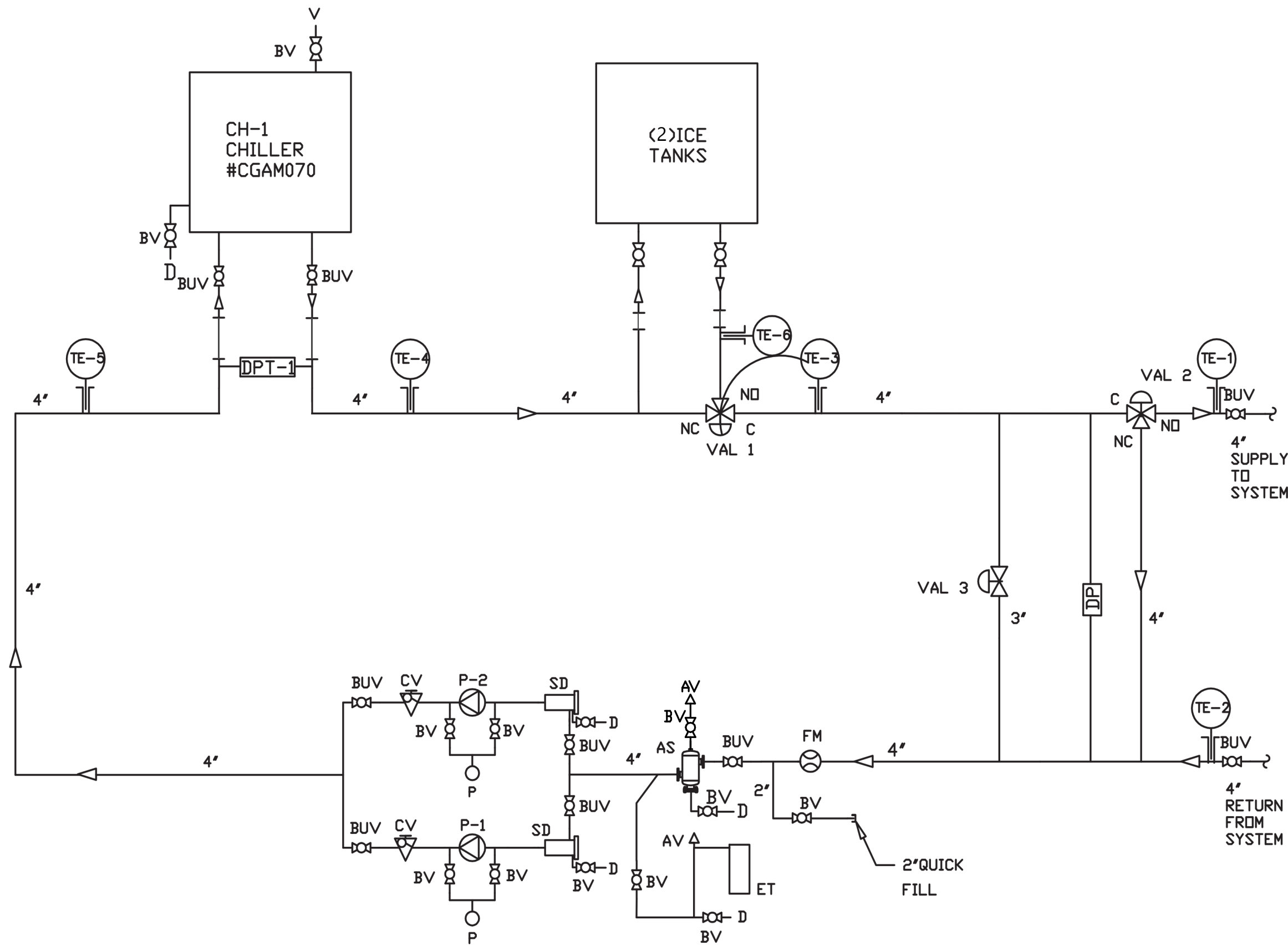
DRAWING TITLE
MECHANICAL SCHEDULES & DETAILS

M801C

HYDRONIC SPECIALTIES SCHEDULE

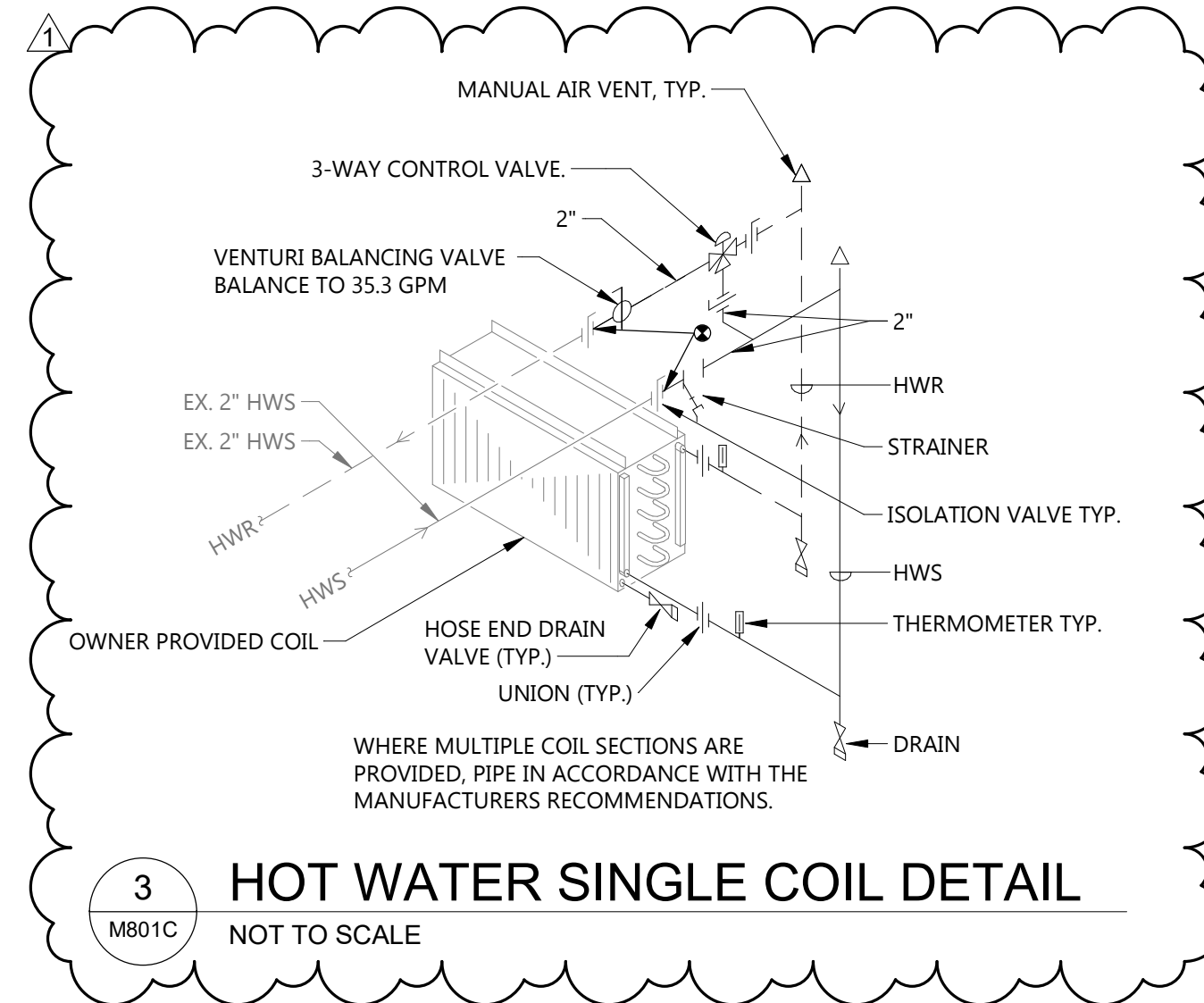
HVAC SYSTEM	DESCRIPTION	MANUFACTURER	MODEL NUMBER	DESIGN CAPACITY	COMMENTS
CHILLED WATER	EXPANSION TANK	ITT BELL & GOSSETT	B165	44 TANK VOLUME (GAL) 44 ACCEPT. VOLUME (GAL)	5
CHILLED WATER	AIR SEPERATOR	ITT BELL & GOSSETT	RL-4F	300 GPM	1
CHILLED WATER	HIGH CAPACITY AUTO AIR VENT	ITT BELL & GOSSETT	NO. 107A	150 PSI	2
CHILLED WATER	AUTO AIR VENT	ITT BELL & GOSSETT	NO. 87	150 PSI	
CHILLED WATER	SIDE STREAM FILTER	SHELCO FILTERS	RHB-786-GP4I/O-V	7 GPM	3
CHILLED WATER	VARIABLE AREA FLOWMETER	DWYER	HFB-3-15	2/15 GPM	4
CHILLED WATER	SUCTION DIFFUSER P-1	ITT BELL & GOSSETT	EC-3X	200 GPM	
CHILLED WATER	SUCTION DIFFUSER P-2	ITT BELL & GOSSETT	EC-3X	200 GPM	
CHILLED WATER	RELIEF VALVE	ITT BELL & GOSSETT	1170-50	60 PSI	
CHILLED WATER	GLYCOL MAKE-UP UNIT	AXIOM	DMF300	1 GPM @ 0 PSI 17 GAL TANK	6

- PROVIDE WITH BLOW DOWN VALVE.
- PIPE DISCHARGE TO GLYCOL STORAGE TANK.
- PROVIDE 6 REPLACEMENT 5 MICRON FILTERS.
- PROVIDE BRASS END FITTINGS.
- PROVIDE ASME CONSTRUCTION AND REPLACEABLE BLADDER. 20 PSIG SET PRESSURE.
- PROVIDE WITH LOW LEVEL SAFETY SHUTDOWN SWITCH WITH REMOTE ALARM CONTACT AND INDICATOR LIGHT.

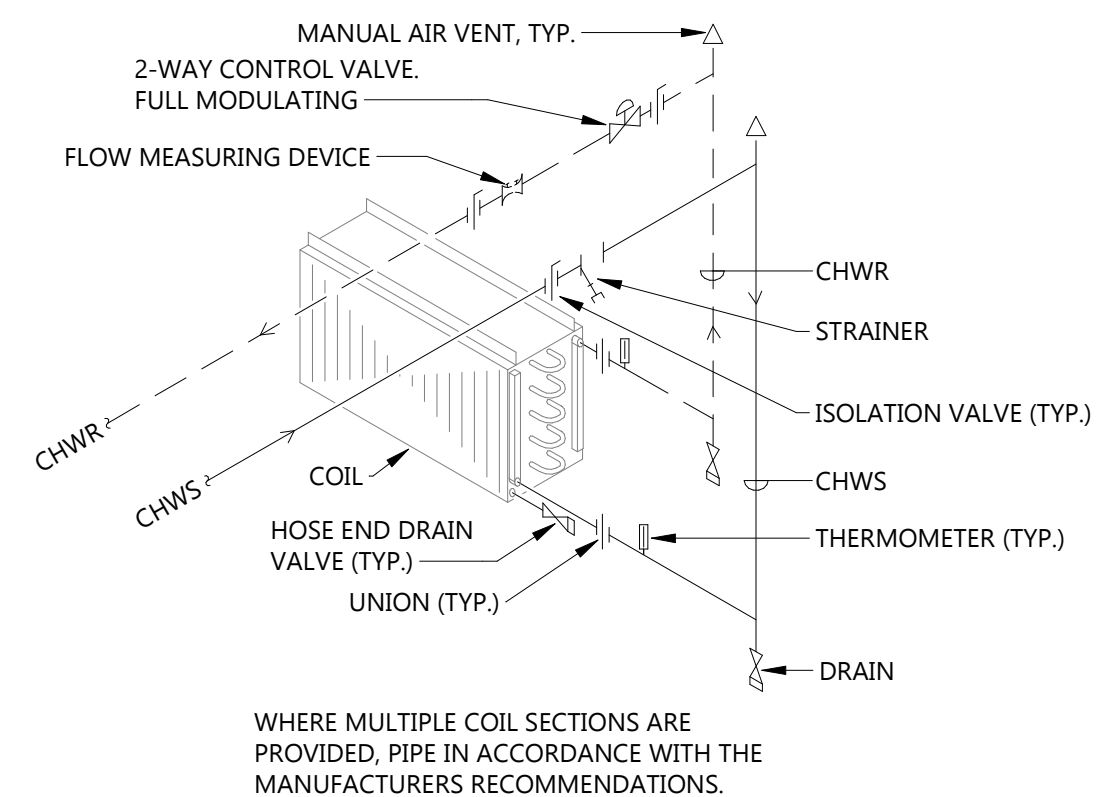


4 CHILLED WATER FLOW DIAGRAM
M801C NOT TO SCALE

TAG	ITEM
AS	AIR SEPARATOR
AV	AUTO AIR VENT
BUV	BUTTERFLY VALVE
BV	BALL VALVE
CH	CHILLER
CV	CHECK VALVE
DPT 1	DP SWITCH
DPT 2	DP SWITCH
D	DRAIN
ET	BLADDER EXPANSION TANK
FLX	FLEX CONNECTOR
FM	FLOW METER
GMU	GLYCOL MAKEUP UNIT
P	PRESSURE GAUGE
P/T	PRESSURE AND TEMPERATURE GAUGES
P1	PUMP 1
P2	PUMP 2
TE-1	SENSOR
TE-2	SENSOR
TE-3	SENSOR
TE-4	SENSOR
TE-5	SENSOR
TE-6	SENSOR
SD	SUCTION DIFFUSER
V	VENT
VAL 1	TANK MOD 3WAY
VAL 2	SYSTEM DIV 3WAY
VAL 3	VP BYPASS 2WAY NC
VAL 4	CHILLER ISD 2WAY NC



3 HOT WATER SINGLE COIL DETAIL
M801C NOT TO SCALE



2 CHILLED WATER SINGLE COIL DETAIL
M801C NOT TO SCALE

ICE STORAGE TANK SCHEDULE

TAG	MANUFACTURER	MODEL NUMBER	LOCATION	CAPACITY (TON-HOURS)	DIMENSIONS W" x D" x H"	GPM	TOTAL HEAD	COMMENTS
ST-1	CALMAC	1320C	EXTERIOR	324	89"x 185"x 102"	160	32.5	1, 2, 3, 4

- PROVIDE WITH ICE INVENTORY METER.
- STORAGE TANK SHALL BE POLYETHYLENE, ABLE TO WITHSTAND TOTAL FREEZING OF THE WATER WITHIN THE TANK.
- FLUID IS 40% ETHYLENE GLYCOL.
- TANK OPERATING WEIGHT IS 34,000 LBS (391 LB/FT²)

PUMP SCHEDULE

TAG	SERVICE	MFGR.	MODEL	PUMP TYPE	GPM	TOTAL HEAD	RPM	BHP	HP	VOLTS/PHASE	COMMENTS
P-1	CHILLED WATER PUMP	BELL & GOSSETT	e-1510 2AD	BASE MOUNTED	192	110	3,600	8.3	10	208 / 3	1, 2, 3
P-2	CHILLED WATER PUMP	BELL & GOSSETT	e-1510 2AD	BASE MOUNTED	192	110	3,600	8.3	10	208 / 3	1, 2, 3

- PUMPS TO OPERATE IN LEAD/LAG OPERATION ONE PUMP IS REDUNDANT.
- VFD BY SECTION 230923.30. PROVIDE SHAFT GROUNDING KITS FOR PUMPS W/ VFD'S.
- FLUID IS 40% PROPYLENE GLYCOL.

COOLING COIL SCHEDULE

TAG	UNIT SERVED	MANUFACTURER	MODEL NUMBER	CFM	ROWS	FIN SIZE	L	TONS	EAT DB F	EAT WB F	LAT WB F	LAT DB F	APD "wg	GPM	EWT F	LWT F	WPD ft	DIMENSION (L"xW"xH")	COMMENTS
CC-1	AHU-1	DAIKIN	5WS1210B	10,500	10	36	84.5	35.5	80.00	67.00	54.00	53.80	1.32	63.80	42	54	14.30	98.37"x15.12"x38"	1, 2
CC-2	AHU-2	DAIKIN	5WS1210B	10,500	10	36	84.5	35.5	80.00	67.00	54.00	53.80	1.32	63.80	42	54	14.30	98.37"x15.12"x38"	1, 2

- 40% ETHYLENE GLYCOL / PURIFIED WATER SOLUTION.
- FIELD VERIFY EXACT DIMENSIONS AND EXISTING CONDITIONS.

AIR COOLED CHILLER SCHEDULE

TAG	SYSTEM	MANUFACTURER R MODEL #	EVAPORATOR				PERFORMANCE				CONDENSER		ELECTRICAL			NOTES:					
			TONS	EWT °F	LWT °F	GPM	EER	IPLV	AMB. TEMP	REFRIG. TYPE	VOLT/PHASE	MCA (A)	MOP (A)	SCCR							
CH-1	AIR COOLED CHILLER	TRANE CGAM060F2	56.07	54	42	125.3	19.6	42.03	28	22	192	43.50	11.49	17.38	95/70	454B	208/3	261	350	65	1, 2, 3, 4

- UNIT PROVIDED W/SINGLE POINT POWER CONNECTION & FUSED DISCONNECT. CIRCUIT BREAKERS TO HAVE A MINIMUM OF 65K AMPS SCCR RATING.
- 4 SCROLL COMPRESSORS.
- UNIT WEIGHT IS 5232 LBS.
- 40% ETHYLENE GLYCOL / PURIFIED WATER SOLUTION.

GENERAL NOTES:

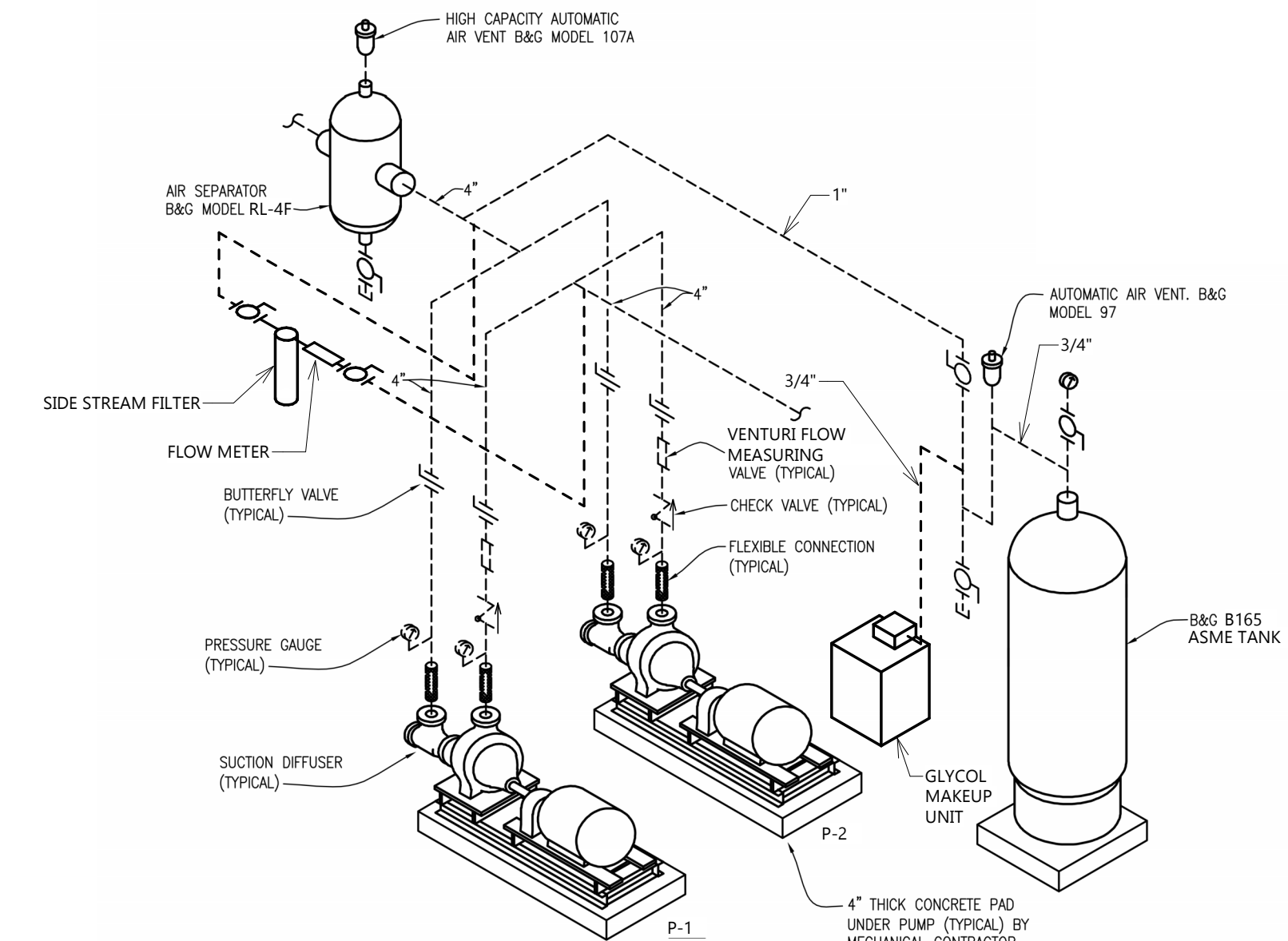
- SERVICE: INDOOR HYDRONIC CHILLED WATER.
 - OPERATING TEMPERATURE: 35 TO 50 DEG F.
 - INSULATION MATERIAL: MINERAL-FIBER.
 - INSULATION THICKNESS: APPLY THE FOLLOWING INSULATION THICKNESS:
 - PIPE SIZE 1.5" AND LESS, 1" THICK.
 - PIPE SIZE 2" AND LARGER, 1-1/2" THICK.
- SERVICE: EXTERIOR HYDRONIC CHILLED WATER.
 - OPERATING TEMPERATURE: 35 TO 50 DEG F.
 - INSULATION MATERIAL: CLOSED CELL PREFORMED PIPE (POLYSTYRENE OR POLYISOCYANURATE).
 - INSULATION THICKNESS: APPLY THE FOLLOWING INSULATION THICKNESS:
 - PIPE SIZE 1.5" AND LESS, 1" THICK.
 - PIPE SIZE 2" AND LARGER, 1-1/2" THICK.
 - VAPOR RETARDER REQUIRED: YES.
 - FIELD APPLIED JACKET: ALUMINUM MILL FINISH.

HYDRONIC SYSTEM BALANCING

HYDRONIC SYSTEMS SHALL PROVIDE FLOW RATE WITHIN +/-10 PERCENT OF DESIGN CAPACITIES AND PUMP IMPELLERS SHALL BE TRIMMED OR PUMP SPEED SHALL BE ADJUSTED TO MEET DESIGN FLOW CONDITIONS.

SYSTEMS BALANCING REPORTS

SYSTEM BALANCING REPORTS SHALL VERIFY SYSTEM PERFORMANCE, SYSTEM BALANCING REPORTS SHALL BE SUBMITTED TO THE BUILDING OFFICIAL UPON REQUEST.



1 BASE MOUNT PUMP DETAIL
M801C NOT TO SCALE