SUBJECT: **Seismic Requirements Removal, RFI Changes, & Scope Clarification** **BULLETIN 03**

☒OWNER Cornell University (CU)
☒ARCHITECT Goody Clancy & Associates (GCA)
☒CONTRACTOR Whiting-Turner (WT)
☐CONSULTANT

PROJECT: Cornell University Balch Hall Renovation **DATE: 8/5/22**

TO: The Whiting-Turner Contracting Company
1720 Spillman Drive Suite 180
Bethlehem, PA 18015
ATTN: Zack Lynn

ARCHITECT'S PROJ. NO: 07400
CONTRACT DATE:
CONTRACT FOR:

SUPPLEMENTAL INSTRUCTIONS ☐ **(SI)**
The work shall be carried out in accordance with the supplemental instructions described herein issued in accordance with the Contract Documents without change in the Contract Sum or Contract Time. Prior to proceeding in accordance with these instructions, indicate your acceptance of these instructions for minor change to the Work as consistent with the Contract Documents and return a copy to the Architect.

PROPOSAL REQUEST ☒ **(PR)**
Please submit an itemized quotation for the changes in the Contract Sum and/or Contract Time incidental to proposed modifications to the Contract Documents described herein. THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.

CONSTRUCTION CHANGE DIRECTIVE ☐ **(CCD)**
You are hereby directed to make change(s) in the Contract as described herein.

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustments to the Contract Sum is:
☐ Lump sum (increase) (decrease) of $
☐ Unit Price of $_____ per_____
☐ Time & materials not to exceed $
☐ Final cost to be determined
2. The Contract Time is proposed to remain unchanged

When signed by the Owner and architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the changes as described herein.
Signature by the Contractor indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive.

Origin: Owner requested DHW changes per RFI 006 and removal of all seismic references from drawings and specifications. Changes to louver/window assembly details per RFI 014 and sound attenuation per RFI 007. Revisions to Specification 088123 and sheet D1.11A to clarify scope indicated on Architectural drawings.

SPECIFICATION CHANGES:

000110 - Table of Contents
- Annotated to show revised sections

088123 – Exterior Glass Glazing
- Revised section 2.3C

220500 - Common Work Results For Plumbing
- Removed references to seismic restraints

220529 - Hangers and Supports For Plumbing Piping and Equipment
- Removed references to seismic restraints

221116 - Domestic Water Piping
- Removed references to seismic restraints

221316 - Sanitary Waste and Vent Piping
- Removed references to seismic restraints

221413 - Facility Storm Drainage Piping
- Removed references to seismic restraints

DRAWING CHANGES:

X0.02
- Removed M8.12, M8.13, & M8.14 from drawing list

D1.11A
- Revise notes to clarify scope indicated on Architectural drawings.

A4.16-A6
- Removed sheet from drawing set

A4.16-A7
- Removed sheet from drawing set

A6.82
- Revised window detail 7/6.82.

A6.92
- Revised louver detail 3/6.92.

A6.93
- Revised window detail 2/6.93.

M0.04
- Removed SCP 3&4 from schedule and updated parameters for SCP 1&2
- Added owner provided HX skid to schedule.

M3.05
- Updated single line to reflect removal of DHW steam plant

M3.06
- Updated mechanical heating hot water single line add DWH-1 and associated piping.

M5.11A
- Change steam piping to HHHW piping and removal of steam condensate skid.

M5.11C
- Changes to steam/HHW piping.

M5.11D
- Changes to steam/HHW piping

M5.12D
- Changes to steam/HHW piping

M7.05
- Piping updates and equipment location updates to match change in heating plant.

M7.06
- Updates to sections to reflect changes to piping.

M8.11
- Removal of DHW Steam plant piping detail

M9.05
- Updates to heating plant controls to reflect plant changes.

M9.06
- Updates to heating plant controls to reflect changes to plant.

E0.03
- Removed SCP3&4 (Steam condensate pump) from the equipment connection schedule, and revised the connection for SCP1&2.
- Added SHX 1&2 to equipment connection schedule.

E5.11A
- Removed electrical connection for SCP1&2.

E5.12D
- Added disconnect for SHX 1&2.
- Revised layout of various electrical disconnects and receptacles to accommodate for shift of other mechanical equipment.
- Revised SCP3&4 tagging to SCP1&2.

E9.12
- Revised LEP-OS-105 circuit #27 to spare for removal of SCP1&2.

E9.13
- Revised LEP-OS-204 circuit #60 to be used for SHX 1&2.
- Revised SCP3&4 tagging to SCP1&2.

Attachments:

Specifications:
000110 Table of Contents, 088123 Exterior Glass Glazing, 220500 Common Work Results For Plumbing, 220529 Hangers and Supports For Plumbing Piping and Equipment, 221116 Domestic Water Piping, 221316 Sanitary Waste and Vent Piping, 221413 Facility Storm Drainage Piping

Drawing Sheets:
X0.02, D1.11A, A6.82, A6.92, A6.93, M0.04, M3.05, M3.06, M5.11A, M5.11C, M5.11D, M5.12D, M7.05, M7.06, M8.11, M9.05, M9.06, E0.03, E5.11A, E5.12D, E9.12, E9.13

End of Bulletin 03

Issued by:		Accepted by:		Accepted by:	
8/5/22					
Architect	Date:	Contractor	Date	Owner	Date

TABLE OF CONTENTS

VOLUME 1 *(DIVISIONS 00 THROUGH 22)*

End - Table of Contents

Section 08 81 23

EXTERIOR GLASS GLAZING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. The Contract Forms, and Conditions of the Contract provided by Cornell University, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

A. General requirements and definition of glass types for glazing work specified under other individual specifications.
   1. Insulated glass in aluminum windows.
   2. Insulated glass in exterior doors.

B. Furnish and install the following:
   1. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.

C. Work of this section includes installation of glazing beads furnished under related sections.

1.3 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4.1, LEED for Building Design and Construction*, *LEED BD+C* certificate goals.

C. Section 06 10 00 - ROUGH CARPENTRY: Installation of steel door frames.

D. Section 06 20 00 - FINISH CARPENTRY: Installation of doors.

E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.

F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and window frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.

G. Section 08 14 33 - STILE AND RAIL WOOD DOORS.

H. Section 08 14 34 - CUSTOM FABRICATED STILE AND RAIL WOOD DOORS.

I. Section 08 51 13 – ALUMINUM WINDOWS.

J. Section 08 14 34 – CUSTOM FABRICATED STILE AND RAIL WOOD DOORS AND FRAMES.

K. Section 08 81 23 - EXTERIOR GLASS GLAZING.

L. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

1.4 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. AAMA 804.1 - Ductile Back-Bedding Compound.
2. ASTM C 1036 - Flat Glass.
3. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
4. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
5. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
6. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
7. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
8. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
9. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
10. IGCC: Certified Products Directory, and Certification Guidelines.
11. NFPA Publication 80 - Fire Doors and Windows.
12. SGCC: Certified Products Directory, and Certification Guidelines.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. GANA Laminated Glazing Reference Manual (2009 edition).
2. GANA - Glazing Manual (50th Anniversary edition).
3. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
4. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data:

a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.

b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.

3. Verification Samples:

a. 12 x 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.

b. Glazing tape: 12 inch length of specified type and size.

4. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.

5. Source Quality Control Submittals:

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:

a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.7 QUALITY ASSURANCE

A. General: Perform glazing work in accordance with GANA Glazing Manual, SIGMA and LSGA standards for glazing and installations methods.

1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Glass Labeling:

1. General: Manufacturer’s Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.

a. Safety glass: Label tempered and laminated safety glass with permanent manufacturer's label on each light with the mark visible after installation. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.

2. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.

C. Qualifications:

1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Deliver materials in labeled, protective packages, when and as required.

B. Storage and Handling Requirements:

1. Store and handle in strict compliance with manufacturer’s instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.

a. Carefully store materials to avoid overloading any building component or structure.

b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.

2. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.9 SITE CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.10 WARRANTY

A. Warranties: Provide the following warranties under provisions of Section 01 78 36 – WARRANTIES AND BONDS.

B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.

1. Insulating Glass: Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.

a. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.

2. Laminated glass: Manufacturer's 4 year written guarantee covering against defects in materials and workmanship of laminated glass and replacement of the same. Warranty shall be effective from date of original factory shipment to site.

a. Provide coverage in Guarantee for manufacturing defects, including failure of laminated glass units as evidenced by edge separation, delamination, or discoloration of inner layer.

PART 2 - PRODUCTS

2.1 GLASS - GENERAL

A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.

1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

B. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.

C. Float Glass: Comply with ASTM C 1036, Class 1 clear, quality q3 glazing select.

D. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.

E. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.

F. Laminated glass: consisting of an outer face and inner face of specified glass, factory laminated to polyvinyl butyl (PVB) interlayer equal to Monsanto "Saflex" or DuPont "Butacite", or DuPont high strength interlayer "SentryGlassPlus". Certified by Safety Glazing Certification Council. Glass shall be free from foreign substances and air pockets.

2.2 REQUIREMENTS FOR SAFETY GLASS

A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
3. Glazing in storm doors.
4. Glazing in unframed swinging doors.

5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

2.3 GLASS – TYPES

A. Glass Type GL-1: Insulated double “Low-E,” glass 1 inch thick units with internal simulated divided lights coordinated and aligned with window muntins:

1. Basis of Design: ~~Vitro Architectural Glass, Pittsburgh PA (formerly PPG) “Solarban 70XL (2)”.~~ **Guardian Industries Corporation, Auburn Hills, MI., product “SNX62/27”.**
2. Components
   a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      1) Provide aluminum muntins on number 1 surface (surface applied to glass, or mechanically fastened to window sash), ½ inch flat stock, and internal floating grid between number 2 and 3 surfaces.
   b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.

c. Air space: 1/2 inch (13 mm) thick.
   1) Gas fill: 90% Argon/10% Air.

B. Glass Type GL-2 - Insulated Glass with frosted appearance: 1 inch thickness, with internal simulated divided lights coordinated and aligned with window muntins:
   1. Basis of Design: Same as Glass Type 1, as modified herein below.
      a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
         1) Provide aluminum muntins on number 1 surface (surface applied or mechanically fastened), ½ inch flat stock, and internal floating grid between number 2 and 3 surfaces.
      b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass with laminated "obscure" frosted laminated on number 3 surface..\
         1) 'Frosted' Laminate: Equal to Eastman Chemical Company (Saflex Brand), St. Louis, MO., product "Vanceva Artic Snow."
      c. Air space: 1/2 inch (13 mm) thick.
         1) Gas fill: 90% Argon/10% Air.

b. Inner layer: 1/4 inch (6 mm) thick clear heat- strengthened glass **with laminated** "**obscure**" **frosted laminated on number 3 surface..**
1) '**Frosted**' **Laminate: Equal to Eastman Chemical Company (Saflex Brand), St. Louis, MO., product** "**Vanceva Artic Snow.**"

C. Glass Type GL-3 (areaways): Insulated double "Low-E," glass 1 inch thick units:
   1. Basis of Design: ~~Vitro Architectural Glass, Pittsburgh PA (formerly PPG) "Solarban 70XL (2)".~~ **Guardian Industries Corporation, Auburn Hills, MI., product "SNX62/27".**
   2. Components
      a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.
      b. ~~Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.~~
      c. Air space: 1/2 inch (13 mm) thick.
         1) Gas fill: 90% Argon/10% Air.

Bltn 3

D. Glass Type GL-4: Insulated double "Low-E," glass 1 inch thick units:
   1. Basis of Design: ~~Vitro Architectural Glass, Pittsburgh PA (formerly PPG) "Solarban 70XL (2)".~~ **Guardian Industries Corporation, Auburn Hills, MI., product "SNX62/27".**
   2. Components
      a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with pyrolytic Low-E sputter coating on number 2 surface.
         1) Provide with exterior self adhesive Lead Caming Tape, came thickness to match existing caming on number 1 and 2 surfaces.
      b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.
      c. Air space: 1/2 inch (13 mm) thick.
         1) Gas fill: 90% Argon/10% Air.

E. Glass Type GL-5 - Insulated Glass with frosted appearance: 1 inch thickness, consisting of:
   1. Basis of Design: Same as Glass Type 1, as modified herein below.
      a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.

1) Provide with exterior self adhesive Lead Caming Tape, came thickness to match existing caming on number 1 and 2 surfaces.

b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass with laminated “obscure” frosted laminated on number 3 surface..\

1) ‘Frosted’ Laminate: Equal to Eastman Chemical Company (Saflex Brand), St. Louis, MO., product “Vanceva Artic Snow.”

c. Air space: 1/2 inch (13 mm) thick.

1) Gas fill: 90% Argon/10% Air.

F. Glass Type GL-6 - Insulated Fire-rated Glass: 1-5/16 inch thickness, consisting of:

1. Basis of Design: Same as Glass Type 1, as modified herein below.

a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened clear glass, with Low-E sputter coating on number 2 surface.

1) Provide aluminum muntins on number 1 surface (surfaced applied or mechanicall fastened), ½ inch flat stock, and internal floating grid between number 2 and 3 surfaces.

2) Inner layer: “Fire Protective Glass”: 45 minute rated 3/4 inch transparent wire-less fire rated laminated ceramic glazing material with polished finish.

a) Basis of Design: Pilkington Pyrostop 25-260.

b) Conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257, and glass to be labeled “O” or “W”.

c) Conform with latest edition of NFPA 257 for Hose Stream Testing, and glass shall be labeled “H” designation.

d) Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

e) In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.

Permanently identify each individual glazing unit with a listing mark visible after installation.

b. Air space: 1/4 inch (13 mm) thick.

1) Gas fill: 90% Argon/10% Air.

G. Glass Type GL-7: Insulated double “Low-E,” glass 1 inch thick units:

1. Basis of Design: ~~Vitro Architectural Glass, Pittsburgh PA (formerly PPG) “Solarban 70XL (2)”.~~ **Guardian Industries Corporation, Auburn Hills, MI., product “SNX62/27”.**

2. Components

a. Outer layer: 1/4 inch (6 mm) thick tempered clear glass, with Low-E sputter coating on number 2 surface.

1) Provide aluminum muntins on number 1 surface (surface applied or mechanically fastened), ½ inch flat stock, and floating grid ½ inch flat stock.

b. Inner layer: 1/4 inch (6 mm) thick clear tempered glass.

c. Air space: 1/2 inch (13 mm) thick.

1) Gas fill: 90% Argon/10% Air.

H. Glass Type GL-8: IGU/Clear (Shafts): Provide siumated divided lites to match existin grid pattern, color and profile; install muntins at surface 1, and floating grid in-between surfaces numbers 2 and 3.

1. No Low-E coatings for GL-8.

2.4 FABRICATION

A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.

1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.

C. Fabricate glass with the following edge treatments.

1. Exposed edges: Polished-finished radiused (penciled).
2. Concealed edges: Cut edges with minimum edge work.
3. Butt-joint edges: Flat round and finished with edges eased.

D. Shop Fabrication:

1. All vision panels and baffles shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.

2.5 ACCESSORIES

A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:

1. Protective treatments 3030 or 606.
2. Tremco Preshimmed 440.
3. Woodmont Chem-Tape 40.

B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be “silicone compatible”; sized as follows:

1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
2. Width: equal to glazing rabbet space minus 1/16 inch.
3. Height to suit glazing method and pane weight and area.

C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.

D. Glazing sealant:

1. Joint Sealer Type SG (Silicone, general-purpose on-site glazing and repair glazing sealant): One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 50 for uses NT, G and A. Color as selected by Architect:
   a. Dow Corning, product “795”.
   b. GE Silicones, product “SilGlaze II SCS2800”.
   c. Tremco, product, “Spectrim 2”.

E. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.

F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.

B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
   1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
   2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

C. Beginning of installation means acceptance of existing conditions.

3.2 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS

A. Install glass units so that appropriate manufacturer’s permanent label for safety glass, and permanent label for fire-rated glass are visible.

3.3 INSTALLATION - WET GLAZING

A. Utilize wet glazing methods for field installation of glass in exterior curtainwall, storefront, window systems at exterior custom stile and rail wood doors.

B. Place setting blocks at quarter points on web of sill receiving member. Set glass unit in place with equal spaces on all sides.

C. Install spacers at a spacing not exceeding 24 inches apart uniformly around perimeter, between interior face of glass unit and the fixed glazing rabbet.

D. Apply a continuous heel bead of specified sealant between the outer edges if the glass unit and the web of the receiving member, in sufficient quantity to engage the leg of the applied glazing stop, when installed.

E. As the glazing stop is being applied, install spacers between the outer face of the glass unit and the stop, locating the spacers directly opposite the previously installed interior spacers. Install the glazing stops, ensuring that all clearances around the perimeter of the glass unit conform to the requirements of the respective standards referenced herein.

F. Apply a continuous bead of sealant around the exterior and interior perimeters, between the glass unit and the fixed rabbet, and between the glass unit and the applied glazing stop, extending the sealant material slightly above the sight line to permit proper tooling thereof.

G. Tool all exposed sealant at a 45 degree angle away from the glass surface, leaving the sealant surface uniformly dense and smooth.

H. Immediately remove all excess sealant from surfaces of metal and glass.

3.4 PROTECTION

A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.

B. Cover glass To protect it from activities that might abrade the glass surface.

3.5 CLEANING

A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

3.6 SAFETY GLASS SCHEDULE

A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
3. Glazing in storm doors.
4. Glazing in unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where

there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)

8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

End of Section

Section 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete working installation with all equipment in proper operational condition. Documents may not show or list every item required. The documents do not undertake to show or list every item to be provided. When an item not shown or listed is necessary for the proper operation of equipment which is shown or listed, provide an item which will allow the system to function properly at no increase in Contract Sum.

B. Should there be any direct conflict in the specifications and drawings the most stringent requirement shall govern.

C. Provide all control devices for mechanical equipment and systems in conjunction with control system requirements, including coordination with Division 26 for electrical connection for complete, tested and operational systems.

D. The requirements of this section apply to all the Work of Division 22.

E. The scope of work shall include but not be limited to the following:
1. Provide and install all piping for domestic water, natural gas, sanitary, storm, fuel oil system valves, specialties and accessories.
2. Provide and install water heater, and accessories.
3. Provide testing, adjusting and balancing for all systems.
4. Carry out the commissioning requirements specified in Section 23 08 00 and other sections referenced in Division 1.
5. Provide, design, dimension, coordinate, and install the following items specified as design build under specified performance criteria:
   a. Support and anchorage of all equipment, valving, and piping. Refer to Section 22 05 29.

Bltn 3

   b. ~~Vibration isolation and seismic anchorage. Refer to Section 22 05 48.~~

F. Related Sections
1. All sections within Division 23 - Heating, Ventilating, and Air Conditioning
2. All sections within Division 21 – Fire Protection System
3. All sections within Division 22 – Plumbing Systems
4. All relevant sections within Division 26 – Electrical
5. All sections within Division 1 - General Requirements
6. Relevant sections within Division 3 - Concrete
   a. Section 3 30 00 - Cast-In-Place Concrete
7. Relevant sections within Division 5 - Metals
   a. Section 55000 – Metal Fabrications
   b. Section 55213 – Pipe and Tube Railings
8. Relevant sections within Division 7 - Thermal and Moisture Protection
   a. Section 07 84 00 - Fire Stopping

9. Relevant sections within Division 08 - Openings
   a. Section 8 71 00 - Door Hardware
   b. Section 89000 – Louvers and Vents
10. Provisions of general LEED requirements and forms: 018113 "Sustainable Design Requirements".

G. Comments on Construction Documents Drawings
1. The drawings show the general arrangement of all piping, and equipment. Examine drawings and specifications very carefully and notify the Architect and/or Owner's Representative by letter or Request for Information (RFI) of any discrepancies so these can be rectified at an early date.
2. Should conditions necessitate any rearrangements, the Contractor shall prepare and submit drawings showing the changes before proceeding with the work. If such changes are approved, they shall become a part of this contract after their approval.
3. Due to the small scale of the drawings, it is not possible to show all offsets and every detail of construction. Additional fittings, valves, traps, transitions, ducts, etc., shall be furnished and installed at no extra cost to the Owner.
4. The drawings are diagrammatic and are a graphic representation of the Contract Requirements, produced according to the best available standards to an optimum scale. Dimensions of work as indicated on plans are not guaranteed to be as-built dimensions. No measurements shall be scaled from the Drawings for use as a definite dimension for layout or fitting work in place. The Contractor is solely responsible for dimensional control and coordination of the work to be installed.
5. The layout of equipment, as shown on the plans, shall be checked and exact location determined by dimensions of equipment accepted for installation. Consult the Architectural and Structural Drawings for all dimensions, locations of partitions, sizes of structural members, foundations, etc.
6. The Contractor shall be responsible for the coordination of the plumbing systems with mechanical ducting and piping distribution, with the fire sprinklers, lighting, conduit, cable tray, structural members, ceiling support and all other trades present within the project.

H. Minor Deviation from Construction Documents
1. The dimensions and ratings of equipment herein specified or indicated on the Drawings are intended to establish the desired performance characteristics of such equipment. Minor deviations may be permitted after review by the Engineer and/or Owner's Representative to allow manufacturers specified to bid on their nearest standard equipment that provides at least the performance required.
2. Manufacturers' catalog or model numbers and types mentioned in the Specifications or indicated on the drawings are used as design guides. In all cases, the manufacturer shall verify the duty specified with the particular characteristics of the equipment he intends to submit and shall submit only items which comply with Specification requirements.
3. Where the equipment furnished differs in physical character from that specified or indicated, or where Contractor's substituted equipment requires increased service and facilities to be provided by other trades,

and such substitution is acceptable to the Engineer, Architect and/or Owner's Representative, the Contractor shall bear all costs of providing services, facilities and modifications to the system or building.

4. Where the equipment furnished requires redesign of systems, connections, or configuration, and such substitution is acceptable to the Engineer, Architect, and/or Owner's Representative, the contractor shall bear all costs associated with design engineering and shall pay the time and materials cost of the Engineer, Architect and/or owner's representative's review of this documentation. In addition, it is the contractor's responsibility to obtain approval from the authority having jurisdiction.

1.2 REFERENCES

A. References to standard codes, specification of regulatory agencies shall mean editions in effect at date of proposal. Reference to technical societies, trade organizations, governmental agencies is made in this Division in accordance with the following abbreviations:

1.	AGA	American Gas Standard
2.	ANSI	American National Standards Institute
3.	ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
4.	ASME	American Society of Mechanical Engineers
5.	ASSE	American Society of Sanitary Engineering
6.	ASTM	American Society for Testing and Materials
7.	AWWA	American Water Works Association
8.	AWS	American Welding Society
9.	CDA	Copper Development Association
10.	CISPI	Cast Iron Soil Pipe Institute
11.	EPA	Environmental Protection Agency
12.	IAPMO	International Association of Plumbing and Mechanical Officials
13.	NEC	National Electrical Code
14.	NEMA	National Electrical Manufacturers' Association
15.	OSHA	Occupational Safety and Health Administration
16.	PDI	Plumbing and Drainage Institute
17.	UL	Underwriters Laboratories, Inc.
18.	FM	FM Global

1.3 QUALITY ASSURANCE

A. Nothing in these plans or specifications is to be construed to permit work not conforming to the prevailing codes and regulations. Should there be any direct conflict between any referenced standard and the governing code, the mandatory code language shall govern to set only the minimum requirements and the most stringent requirement shall govern. A letter or Request for Information (RFI) shall be generated to highlight the discrepancy.

B. Install Work by craftsmen skilled in the trade involved and by apprentices as indicated in the General Conditions.

C. Electrical Testing: Provide the services of a qualified testing laboratory/agency to perform the specified field tests. Notify the Owner's Representative 24 hours in advance of performance of Work requiring testing. Provide all materials required for testing. Refer to Division 26 for detailed requirements of electrical testing.

D. Factory and Field Testing
   1. See each Section for the required testing and procedures.
   2. Test reports shall include:
      a. Description of equipment tested.
      b. Description of test procedures.
      c. Test results.
      d. Names and signatures of witnesses of tests.

E. Performance testing
   1. Upon completion of the Work and following adjustment of all equipment, conduct an operating test for each system's acceptance. Demonstrate all systems and equipment to be operational and free from all electrical and mechanical defects.
   2. Notify the Owner's Representative fourteen days in advance of when tests will be performed. At that time, provide a test procedure plan, test schedule and test procedure forms.
   3. Coordinate the work of Performance Testing with the Commissioning Requirements for Pre-Functional and Functional Testing.

F. Materials and Workmanship
   1. Materials shall be new, meet detailed requirements of the contract document and be identifiable as being specified or substitute products. Materials shall be kept in original packing material and protected from the elements by plastic and placed on dunnage until the item is installed. Once installed, all electrical devices shall be covered with sealed plastic until the building is fully enclosed and all spraying applications are complete.
   2. Materials that do not conform to the requirements of the contract documents, are not equal to approved samples or are unsatisfactory or unsuited to the purpose for which they are intended, will be rejected and shall not be installed.
   3. All work shall be performed by properly licensed plumbers, mechanics, and technicians with work limited to their respective trades.
   4. All equipment shall be installed in accordance with the recommendation of the manufacturer.
   5. Defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or other cause shall be removed within ten (10) days after written notice is given by the Owner's Representative, and the work shall be re-executed by the Contractor. The fact that the Owner's Representative may have previously overlooked such defective work shall not constitute total or partial acceptance of it.
   6. In no case shall a Bidder base his bid on a class of material or workmanship less than that required by the contract documents nor the governing codes and ordinances.
   7. Materials and adhesives used throughout the plumbing systems for insulation, flexible connections and jackets or coverings regardless of kind for piping system components, shall have a flame spread rating not

over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

G. Checking and Testing Equipment By Contractors and Manufacturer's Representative
   1. All equipment shall be installed per the manufacturer's instructions. During construction request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed. After installation, request the Owner's Representative to inspect and see the equipment is in proper working order.
   2. Manufacturer's representative shall review the overall system design relative to the proper application of his equipment in the particular system. That person shall note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.
   3. Before equipment start up, the manufacturer's representative shall submit to the Owner's Representative, a signed statement certifying to their inspection and noting that the equipment is properly installed and ready for operation.

1.4 SUBMITTALS

A. Section 1 33 00 - Submittal Procedures

B. Preliminary List of Materials and Equipment
   1. Submit a Preliminary List of Materials and Equipment to the Owner's Representative for approval of manufacturers of all materials and equipment proposed to be provided for this project.
   2. The review of the Preliminary List of Material and Equipment shall only be construed to be a general review that the manufacturer is a recognized and reputable supplier of that general type of product and therefore eligible to submit his product in detail for review. The review designation of “no exception taken” to the Preliminary List does not exempt the Contractor from proving that the particular and specific equipment meets the project’s requirements.
   3. Submit the List of Materials and Equipment for review/approval in accordance with Section 1 33 00: Submittal Procedures. Submit at least one month prior to the first submittal.

C. Submittal Schedule
   1. Provide a submittal schedule at least one month prior to the first submittal.
   2. The submittal schedule shall be a complete list of all submittals to be made with projected date of submittal.
   3. The submittal schedule shall assume at least one “Revise and Resubmit” cycle. Delay to schedule associated with submittals’ “Revise and Resubmit” designation are ineligible for change orders, as timely and correct work is a requirement of this contract.

D. General Organization of Submittals

1. Submit as a minimum all the required data listed in the documents as specifying performance, material, and dimensions. Refer to individual specification sections, schedules, and drawings for requirements.
2. Organize submittals in the same sequence as they appear in specification sections, articles or paragraphs.
3. Each submission shall be made under the Specification Section Number it has been specified under. Submittals including equipment specified under a different specification section will be rejected and returned without review. Each section is required to be tracked separately for status designation, even if multiple sections are physically collated into a single binder.
4. Identify each item with each submittal by reference to Specification Section paragraph in which the item is specified or Drawing and Detail number. Annotate the submittal sheets with the equipment identification numbers appearing on the equipment schedule.
5. Include all information requested by the Specification Section in a single submittal. With the exception of shop drawings, incomplete submittals or phased submittals under the same specification section are not acceptable and will be returned without review.
6. Submit pertinent catalog and performance data sheets only. Annotate pages to clearly identify which specific product is submitted and for what tag number or application. Contractors shall not submit entire catalogs.
7. Submission shall be made in the form of a tab-indexed brochure. Index sheets shall be required for all material, plumbing fixtures and equipment, including but not limited to pipe, fittings, valves, insulation, etc. as listed. Index sheets shall be set up with columns to identify the following:
    a. Specification clause number or drawing/detail number
    b. Item type
    c. Tag number as appropriate and/or application
    d. Requirement from drawing schedule and specification
    e. Feature data provided to show compliance
    f. Compliance: yes or no
    g. Notes from Contractor
8. Provide the number of submittal and shop drawing copies as defined under Section 1 33 00.

E. Plumbing Fixtures and Equipment Submittals:
1. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
2. Mark each item and data on each sheet. Where multiple product model types are listed on a single sheet, the contractor shall clearly indicate which specific item is submitted. If different model numbers of a single product line are submitted for different uses, this should be clearly annotated, identifying each individual use cross-referenced by the requirement it intends to fulfill. Submittals without annotation will be rejected and returned without review.
3. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item

and its relevant features or options. Submittals shall include all those items listed in each individual Section.

F. Shop Drawings:
1. Prepare reproducible CAD drawings in AutoCAD.
2. Shop drawings shall be provided for all systems included in Division 23 and for all areas addressed in the Construction Documents.
3. Piping installation drawings shall be fully dimensioned complete with elevations and all fittings, valves, devices. Include details and dimensioned locations of supports, anchors and expansion devices. Dimensions shall be from gridlines. All equipment shall be shown to scale and shall match the required dimensions from the equipment submittals. All equipment access clearances shall be marked explicitly on the Shop Drawings with manufacturer and code required distances dimensioned and annotated as such.
4. The drawings shall be minimum 1/4" = 1'-0" scale.
5. Independent structural support and structural pad drawings shall be submitted for review by Structural Engineer.
6. All equipment shall be labeled to match the schedules.
7. The Contractor shall assure that each trade has coordinated work with other trades, prior to submittal. Division 22 shop drawings shall be issued after the coordination drawings are signed off by all other trades. Any conflicts that occur with other trades shall be brought to the attention of the Owner's Representative prior to issuance of the shop drawings.
8. Shop fabrication, coordination and installation drawings that are prepared to scale by the Contractor are for his use and shall be his responsibility. These Drawings indicate where he intends to install the fixtures, material and equipment as required by the Contract Documents. Submission of contract documents or electronic files of contract documents for shop drawings is not sufficient as this would be an indication that field-level construction coordination has not taken place. Any such submittal will be rejected and returned without review.
9. Prepare and submit supplementary Shop Drawings for all Work in "tight" areas, clearly indicating solutions to space problems and coordination with Work in other Sections. Identify congested conditions and provide a sufficient number of sections to demonstrate the solution proposed. These Drawings, as a requirement of this Division, shall indicate, superimposed, Work of all Sections involved in congested area, including plumbing piping, ductwork, piping, electrical work, ceiling work, equipment access requirements, etc. Include all mechanical rooms at larger scale and with sections under this clause. Identification of space problems without solutions is not acceptable within a shop drawing.
10. During the shop drawing review process the owner’s representative may request that supplementary shop drawings be produced for clarification and explicit demonstration of coordination in congested areas. This work shall be performed by the contractor at no cost as necessary under the previous clause.
11. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations and cross reference through notes the reason why the deviation was made.
12. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance,

access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, weight.

a. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of the Contract Documents.
b. Drawings shall be to scale and dimensioned (except piping diagrams not to scale).
c. Drawings shall clearly show all required openings in construction, points of connection of other trades, and support locations and loads.
d. Drawings may be prepared by vendor but shall be submitted as instruments of the Contractor. Such drawings shall be thoroughly checked and developed by the contractor to include the full contract scope. They shall be stamped by Contractor before submission for review.
e. Catalog cuts and published material may be included to supplement scale drawings.

13. Each drawing shall have a blank space for use by the Owner's Representative and Contractor in recording disposition of material per Section 1 33 00.

G. Coordinated Drawings:
1. Refer to Section 1 33 00 Submittal Procedures for requirements.
2. Coordinated drawings shall be provided for all areas.
3. Coordinated Drawings shall show work of all trades including, but *not limited to:*
   a. Piping, including:
      1) HVAC, Plumbing and Fire Protection.
      2) Minor Piping such as Drains, Air Vents, Condensate Piping, etc.
      3) Sleeves and Penetrations.
      4) Expansion Devices, Anchors, Guides and Hangers, Seismic Anchorage Devices.
   b. Equipment, including points of connection and manufacturer's recommended access space. Nothing shall enter or cross through the required access space, which is defined as the volume extending from the top of the device to be maintained down to the floor. Any ceiling which interrupts this space shall be entirely removable including T-bars, vertical supports and seismic bracing of ceiling which shall be arranged to avoid the access zone.
   c. Supports and Suspension Devices.
   d. Piping High Points and Low Points.
   e. Electrical Equipment.
   f. Main Electrical Conduits and Bus Ducts.
   g. Equipment Support and Suspension Devices including Hangers, Supports and Bracing.
   h. Structural and Architectural Constraints including Beams, Braces, Trusses, Flanges, Constraints, Walls, Openings Ratings, Doors, Wall Types and Glazing.
   i. Show location of:
      1) Valves.
      2) Piping Specialties.

3) Access Doors and Equipment Removal Paths.
4) Control and Electrical Panels.
5) Disconnect, Hand/OFF/Auto, and Emergency Power Off Switches.
6) All control sensors, control panels and required installation distances for access and stable performance.

4. Drawings shall indicate coordination with work in other Divisions which must be incorporated in mechanical spaces, including, but not limited to:
   a. Mechanical equipment, piping and duct.
   b. Irrigation Equipment and Piping.
   c. Elevator Equipment.
   d. Electrical Equipment.
   e. Cable Trays.
5. Provide sections and elevations for all mechanical rooms, mechanical areas, areas with routed piping mains, and areas adjacent to the existing structure.

H. Substitutions:
1. In accordance with Section 1 60 00, and where permitted in each section.
2. Specified products or equipment mean those named on the equipment schedules or identified as Specified Manufacturers herein. All other manufacturers listed are considered substitutions and must meet the requirements of this Section. Only manufacturers identified as Possible Substitutions in this specification may be offered as substitutions for approval.
3. Substitution requests shall come simultaneous to the relevant submittal and shall not come through the RFI process, unless directed by the Owner's Representative.
4. Submit shop drawings and proposed products that differ from the specified products and also indicate products with connections and show arrangements. Show necessary modifications of architectural, structural, plumbing, electrical and mechanical Work required by the proposed products, including relocation of drains, revised electrical circuits, relocation of roof or wall penetrations, and revised foundations.
5. Accompany request for substitution review with table of comparison listing pertinent features of both specified and proposed materials including all scheduled data, material of construction, performance criteria, overall length, width, height dimensions, space required for tube replacement or maintenance access, motor type, horsepower, voltage, phase service factor, noise levels and controls. This is to be submitted in addition to the index sheet required above for all submittals. Review of proposed substitution will not be made without simultaneous receipt of satisfactory comparison tabulation. The substitution request shall also identify the offered reduction in contract value, which shall be inclusive of all cost associated with work by other trades. If paper copies of data from the referenced manufacturer are provided along with the submitted manufacturer as backup data for the table of comparisons, these shall be explicitly separated via tabs clearly marked as follows:
   a. Substitution request and comparison table
   b. Submitted data from requested manufacturer
   c. Reference data from specified manufacturer

6. Limit submittal of substitutions to one proposal for each type or kind of item, unless otherwise explicitly permitted by the Owner. If the proposed product substitution is rejected by the Owner's Representative, submit the specified product at no cost to the project.
7. Review of drawings and other material submitted as a substitution shall not be construed as a complete check or constitute a waiver of the requirements of the Contract Documents. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangement or construction of other Work.
8. Any additional work required by other trades as a result of a substitution shall be covered under this Contract, without any additional cost or time delay imposed on the project.
9. When a substitution is proposed, the Contractor shall be responsible to ensure that the performance and quality of the scheduled or specified equipment is met. If additional accessories are required to achieve performance, they shall be provided at no cost.

I. Resubmittals:
1. Resubmittals shall be reviewed for compliance with the comments made on the original submittal. Clearly identify replies to comments, through a cover letter by the Contractor that lists each comment and the resolution of that comment. Mark with submittal number and date.
2. Non-compliant items which were not noticed in an earlier submittal but are noticed in a resubmittal shall be noted as non-compliant and the resubmittal tagged for corrective action. The fact that the owner's representative may have overlooked the defect shall not constitute total or partial acceptance of it. The contractor remains responsible for delivering an installation that meets the design intent. All corrective action shall be performed at no additional cost or delay to the project.
3. Re-submittals shall be complete and shall be explicitly annotated to note all changes. Contractor shall not just include specific responses to review comments, but shall show how the resubmittal data has been corrected and how all consequences of the change have been accommodated.
4. Changes made in the resubmittal which are not directly a response to an earlier review comment shall be clearly identified on the letter of transmittal provided with the re-submittal and annotated within the body of the submittal. The reason for the change shall be included.
5. One resubmittal will be reviewed. Review time for all second and higher resubmittals will be charged on a time and materials basis to the contractor regardless of the cause of the resubmittal. This will include all submittals to change manufacturer or equipment type after an original submittal was returned with no exceptions taken, unless the change is directly related to a Bulletin.

J. Submittals – Checking
1. Before submitting shop drawings or equipment submittals to the Owner's Representative, the contractor shall check them in detail to be sure that all requirements of the plans and specifications have been fully met.
2. Incomplete submittals and submittals not in accordance with the above requirements shall be returned without action, and resubmittal shall be required.

3. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Contract Documents. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, to coordinate with the other trades and to effect necessary rearrangement or construction of other Work.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of his Work with that of all other trades, for installed performance and the satisfactory quality of his work.
5. Review by the Owner's Representative of Submittals does not release the Contractor from full compliance with the requirements of the plans and specifications when Submittals deviate from these requirements.
6. Even though Submittals have been stamped "Reviewed" and no exceptions have been taken by the Engineer, the Contractor shall be fully responsible for all unauthorized deviations from the Drawings and specifications. Authorization for deviation will be made only by means of a letter from the Owner's Representative. The Owner's Representative's reviewed "No Exceptions Taken" stamp on a Submittal is not an authorization for a deviation from the plans and specifications.
7. Any corrections or modifications made by the Owner's Representative shall be deemed acceptable to the Contractor with no change in contract amount unless written notice is received by the Owner's Representative prior to the performance of any work affected by any corrections or modifications.
8. No material or equipment shall be released for manufacturer or shipment without first obtaining the Owner's Representative approved shop drawings.

1.5 PROJECT RECORD DOCUMENTS

A. In accordance with Section 17700 - Closeout Procedures: Record Documents, and as follows.

B. Keep up-to-date during the progress of the job through, one set of drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base line reference points:
   1. Exact location, type, and function of concealed valves and controllers.
   2. Exact size, invert elevations and location of above floor, underground and under floor piping.

C. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or bend mark. Utility services outside of buildings shall also show depth of burial with reference to the finished ground floor elevation.

D. This set of drawings shall be kept on the project site at all times and shall be available for inspection by Owner's Representative or Construction Manager weekly.

E. Submit completed Drawings to Owner's Representative for approval prior to authorization for final payment. Record drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as record drawings.

F. At the completion of the project the Contractor shall submit record as-built drawings as specified under Section 17700 and their electronic CAD files. Drawings shall incorporate all the Owner's and Architect's comments and represent completed as-built conditions.

1.6 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Instructions and Manuals: In accordance with requirements of Section 17700 and as follows:
   1. Subsequent to completion of balancing and testing operations, this Division is responsible for instructing the owner's authorized representatives in all aspects of operation, adjustment and maintenance of mechanical plant and other mechanical equipment. Submit certificate, signed by owner's representative, attesting to their having been instructed per Section 17700 and as specified under individual Equipment section of this specification.
   2. Instructions on major items such as pumps, water heaters, etc. shall be by representative of manufacturer of the respective equipment.
   3. One month prior to request for final inspection, submit Operating and Maintenance manuals under Section 17700.
   4. Manuals shall include the following:
      a. Section 1: A comprehensive table of contents and guide to the manuals contents and layout. This section shall enable the reader to comprehend the scope and purpose of the document and to identify readily where specific information can be obtained.
      b. Section 2: Contractual and Legal records including:
         1) Name and Address of the installation.
         2) Details of City and State approvals.
         3) Name and Contact details of the Design Team and Installing Contractors and associated sub-contractors.
         4) Dates for Start of Installation, Substantial Completion, and Expiry of Warrantee period.
         5) Copies of maintenance service contracts and contact details for local service company.
         6) Copies of warrantees and bonds.
      c. Subsequent Sections:
         1) Startup and Shutdown Procedures:
            a) Provide a step-by-step write-up of all major equipment. When manufacturer's printed start-up, troubleshooting and shut-down procedures are available, they shall be incorporated into the operating manual for reference.

2) Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3) Service Instructions: Provide the following information for all pieces of equipment:
    a) Recommended spare parts, including catalog number and the name, manufacturer's name and contact information, address and telephone number of local suppliers of factory representative.
4) Lubrication and maintenance instructions and recommended service maintenance schedule for all equipment including all electric motors. Sample maintenance record forms for each equipment type.
5) A lubrication chart listing each item of equipment, all points of lubrication, proper lubricant, dates lubricated, and lubrication schedule.
6) Data sheets to show complete internal wiring, mechanical and electrical ratings and characteristics, catalog data on component parts whether furnished by equipment manufacturer or others, names, addresses and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.
    a) Where data sheets included in manual cover equipment, options, or other features not part of equipment actually furnished, line out these references or otherwise clearly mark so remaining text, diagrams, drawings, schedules, and similar information shall apply specifically to equipment furnished.
    b) Final submittals for equipment shall have final corrections included in the prints used for the manual.
7) Equipment List: List of all major equipment as installed shall include model number, capacities, and nameplate data. Include in the manuals, parts catalogs for each item of equipment furnished by him with the components identified by number of for replacement ordering.
8) Valve charts organized on a room and sequence basis, detailing room, system and valve numbers.

5. Controls Binder: Bind data in vinyl covered loose-leaf binders with title index tabs identifying items therein to include:
    a. Detailed list of all control set points and control and wiring diagrams and software.
    b. Detailed description of sequence of operation of each system, with charts and diagrams. Include emergency operation performance and resetting procedures as appropriate. Include explicit definition of all setpoints, alarm triggers, loop tuning coefficients, and ranges present within programming at time of handover.

c. Provide full size copies of Record one-line diagrams, folded into plastic covers. Obtain Record prints from Owner's Representative at Contractor's cost and have prints thin laminated by a firm normally engaged in this work.
d. Provide laminated control diagrams. Diagrams shall show complete equipment, controls, model numbers, etc., marked to correspond to identification on equipment.

6. Certification Binder
   a. Certificates: Submit final inspection certificates signed by governing authorities.
   b. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.
   c. Machinery vibration test reports.
   d. Certificates of sterilization/chlorination of plumbing systems.
   e. Test certificates.
   f. Instruction certificates.
   g. Final inspection certificate signed by governing authorities.
7. Submit drafts of service and maintenance instruction sheets to Owner's Representative for review before preparing final sets.

1.7 TEMPORARY FACILITIES

A. Temporary Water: Provided under Section 15000.

B. Temporary Light and Power: Provided under Section 15000.

1.8 REGULATIONS, CODES, PERMITS AND FEES

A. Conform to all rules, regulations, laws, and ordinances governing the area in which this construction occurs.

B. Obtain the required permits from the local authorities for this work and pay for all fees required by the State and Federal authorities for permits, inspections and review, including special agency construction and operating permits. Make corrections in the work as required by the Owner's Representative or Inspector to pass local regulations.

C. Provide local authorities with all notices relating to this Division.

D. Provide Owner, Owner's Representative and local Inspectors access to work at all times.

E. Contractor shall be responsible for all law violations caused by the work under this Division. Notify the Owner's Representative in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.

F. Make application and pay for all certificates of inspection, taxes and permits required by Local, State or Federal Governments, public utilities, or other authorities having lawful jurisdiction. Deliver to the Owner's Representative any and all certificates of inspections, permits, and approvals that may be required by such authorities.

1.9 COOPERATION BETWEEN TRADES

A. Division 1 – General Requirements

B. Cooperate with all other Divisions performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine nature and extent of work specified in other Divisions that adjoins, shares space with, or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated, and that maximum headroom and clearance may be obtained. If interferences develop, the Owner's Representative's decision will be final as to which Division shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit or equipment to clear such interferences.

C. Electrical Work for Plumbing Equipment
   1. Division 26 Contractor: Wire all mechanical equipment furnished by this Division in accordance with the following general provisions:
      a. Provide 120-volt emergency power circuits available at panel for control contractor's use.
      b. Provide and wire heavy-duty, quick-make, quick-break type disconnect switches, manual pushbuttons and other fire alarm hard-wiring specifically called for in the documents or noted in electrical specifications and wherever required by Code.
      c. Receive, unload, set, and rough align all separately shipped motors.
      d. Receive, unload, set and install all motor starters and variable frequency drives.
      e. Wire all miscellaneous solenoid valves, relays and other components provided with equipment which is not factory wired or part of control contractor's scope.
      f. Wire fire alarm lighting controls and other monitoring systems for interface with Building Management and Control System.
      g. Wire interlocks between equipment as called for in Controls specifications.
      h. Provide final equipment connections for all equipment with voltage greater than 120-volt, including overcurrent protection and disconnect.
      i. Provide final equipment connections for 120-volt equipment that requires motor starters. Include starter, overcurrent protection, and disconnect.
   2. Division 22 shall provide the following:
      a. All control devices noted on the drawings and within the specifications.
      b. Complete and accurate wiring diagrams to Division 26 for all equipment requiring electrical power wiring.
      c. Separately shipped motors and variable frequency drives shall be installed by Division 26. Adjustable motor bases and all bolts and nuts required for installation of base and motor shall be provided and installed by Division 22.
      d. Field lubricate all motors prior to operation and maintain lubrication prior to acceptance of equipment by the Owner's Representative.

e. Provide motor terminal connection diagram as prepared by motor manufacturers.
f. Provide 120V wiring from dedicated J-box to Control Panels or controllers.
g. Provide control wiring from Control Panel to controlled device.

D. Cutting and Patching
1. The Contractor shall do all cutting of building materials, piping, etc., as required for the installation of work.
2. No structural members shall be cut without the prior approval of the Owner's Representative. To gain approval to cut concrete, Ferroscan the affected area and submit scan results to Structural Engineer for review. Submit to Owner's Representative, drawings and details for the support of structure around the opening. If the standard structural details are to be used, then submit a plan that cross-references all penetrations against detail numbers for review. Otherwise, submit drawings, design, and calculations stamped by a Registered Professional Structural Engineer in the State of New York. Any cutting and remedial support shall be done in a manner satisfactory to the Owner's Representative.
3. Patching of building structure, walls, floors, etc. during normal work progress with Requirements of Division 1.
4. All patching of or repair of damage to completed work in place shall be done to meet with the approval of the Owner's Representative.
5. All cutting shall be performed with machine saw. Holes for pipes in concrete walls or floors shall be drilled with core drilling equipment.
6. Work in place that is subsequently cut is seen as evidence of the contractor's lack of field coordination during the shop drawing production phase. Because field coordination is a requirement of the contract, the contractor must bear all costs of cutting, patching and repair for corrective work

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. Install equipment according to the manufacturer's instructions, code requirements, and required access clearances.

3.2 LOCAL AND EXISTING CONDITIONS

A. Prior to bidding visit the site and determine all existing conditions affecting work in this Division. Examine all Drawings and Specifications to familiarize with the type of construction to be used, and the nature and extent of work of other trades.

B. Observe the conditions under which deliveries of materials and equipment shall be made and under which such materials and equipment can be stored and shall include adequate provision in the bid proposal.

C. Any connections to or relocation of any existing utility line requiring temporary discontinuance of utility services which are in active use shall be scheduled and coordinated with the utility companies and the Owner's Representative. In no case shall the services be left disconnected at the end of a working day or weekend unless authorized by representatives of the utilities and the Owner. Any existing utility service damaged shall be repaired to the satisfaction of the Owner's Representative.

3.3 PROVISIONS FOR LATER INSTALLATIONS

A. At the start of the project, meet with the Owner’s Representative to obtain information regarding allowable sleeve or penetration spacing and size.

B. Where any Plumbing work cannot be installed as the work progresses, the Contractor shall provide and arrange for the building in of boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. This field coordination work shall be completed prior to structural shop drawings and shall follow the principles set forth in the meeting reference above. Arrange for and lay out any chases, holes, or other openings that must be provided in masonry, concrete or other work.

C. The Contractor shall be responsible for being aware of the nature and arrangement of the materials and construction to which the work attaches or passes through, and shall propose support and penetration details that are consistent with maintaining the integrity and performance of the construction such as, but not limited to, fire-resistive construction, acoustically rated construction, vibrated isolated construction, water tight construction, fire proofed construction, and isolated construction.

D. This work shall be incorporated into the initial shop drawing review of the construction (wall, floor, etc.) that is affected so that the owner’s representative may review the impact of the holes.

E. The contractor shall bear the cost of time and materials for the Owner’s Representative to re-analyze the construction if the original spacing principles are not adhered to, for whatever reason.

F. Once the structural shop drawings are returned with no exception taken, the contractor shall bear the cost of time and materials for the owner’s representative to review the appropriateness of cutting or drilled holes in planned or existing construction.

3.4 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the project. All temporary work shall be removed from the premises when its use is no longer required.

B. Prior to placing equipment or scaffolding, the contractor shall provide written verification that the structure on which the load is imposed has sufficient strength to accommodate the point and/or line loads.

3.5 PROTECTION AND STORAGE

A. All stock-piled material shall be placed on pallets and protected from weather and from entry of foreign material and construction dust by plastic. All stored materials and equipment shall be carefully inspected and cleaned prior to installation and replaced with new material or equipment if found to be damaged, corroded, etc.

B. Equipment which is observed to be exposed to the weather, dirt or construction debris can be interpreted by the owner's representative as defective equipment under this clause.

3.6 FIELD VERIFICATION

A. All dimensions, locations of equipment and connections to utilities or pre-existing equipment shall be verified in field prior to construction and installation.

B. Architectural plans will hold precedence over mechanical plans as to location of partitions and diffusers.

C. Measurements in existing buildings shall take precedence over all other plans with regards to identifying location of existing installations.

D. All roughing in construction dimensions shall be made from architectural plans where discrepancies may exist. No change orders will be allowed for shifts in mechanical piping, ductwork, or equipment to match rough-in hole locations within 10 feet or original mechanical drawings.

E. Plumbing plans shall take precedence over electrical and mechanical plans with regards to placement of plumbing equipment and layout of electrical and mechanical equipment within rooms designated as "plumbing rooms."

3.7 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the work.

3.8 EXCAVATION, TRENCHING AND BACKFILL

A. Coordinate trenching and backfill required for the installation of this Division as detailed in Division 31. Repair or replace all street, roadway, sidewalk, pavements and other work incidental thereto.

B. Perform all excavations, trenching, and backfill required to complete the work in this Division, regardless of the character of the materials encountered or the method of excavation required.

C. All excavations shall be inspected by the Owner's Representative and approved before placing of any pipe or duct.

D. Pumping equipment shall be provided as necessary to keep trenches free from standing water. All shoring necessary to maintain the banks of excavations and to prevent any sloughing or caving-in, and as necessary to prevent damage of any kind which may occur in connection with this work shall be furnished and installed by the Contractor.

3.9 CLEANING

A. Clean premises of all excess construction material and debris caused by work, in accordance with Section 17700.

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.

C. Clean exterior of piping and equipment, exposed in complete structure. Remove rust, paint overspray, fireproofing overspray, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.

D. Motors, Pumps and Other Items with Factory Finish: Remove grease, oil, paint overspray, fireproofing overspray, gypsum board mud splatters and leave surfaces clean.

3.10 FINAL INSPECTION

A. As the work nears completion, review the requirements of the Contract Documents, inspect the work and inform all parties involved in work to be corrected or completed before the project can be deemed substantially complete.

B. When the project is substantially complete, notify the Owner's Representative in writing of this fact, listing those items of work remaining incomplete, the reason for incompleteness, and the anticipated date that all remaining work will be completed. Carry out own final inspection and be satisfied that the work is complete. Final inspection of the project will then be scheduled by the Owner's Representative.

C. The Owner's Representative reserves the right to cancel and reschedule the inspection in the event considerable more work remains to be completed or corrected than indicated in the written request for inspection.

D. All items not completed or found not complying with drawings or specifications by the Owner's Representative will be identified in an inspection report by Owner's Representative.

E. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.

3.11 PROJECT CLOSE-OUT

A. Prior to requesting Owner's Representative's inspection for certification of substantial completion, complete the following and list known exceptions in request:
   1. Obtain final inspections and approvals from all governmental jurisdictions that are required for the project.
   2. Submit record drawings, maintenance manuals, warranties, and similar final record information.
   3. Deliver tools, spare parts, extra stocks of materials, and similar physical items to the Owner.
   4. Complete start-up, testing and demonstration of systems to the satisfaction of the Owner's Representative that the entire installation is complete, properly adjusted and is in proper operating condition.
   5. Complete final cleaning requirements.

End of Section

Section 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Thermal-hanger shield inserts.
6. Fastener systems.
7. Pipe stands.
8. Pipe positioning systems.
9. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

Bltn 3 ~~3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.~~

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment

shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Cooper B-Line, Inc.
   b. Flex-Strut Inc.
   c. Thomas & Betts Corporation.
   d. Unistrut Corporation; Tyco International, Ltd.

3. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
4. Standard: MFMA-4.

5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Metallic Coating: Hot-dipped galvanized

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Anvil International; a subsidiary of Mueller Water Products Inc.
    b. Empire Industries, Inc.
    c. Haydon Corporation; H-Strut Division.
    d. NIBCO INC.

3. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
4. Standard: Comply with MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. **Coating: [Zinc].**

2.4 FIBERGLASS STRUT SYSTEMS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Allied Tube & Conduit.
2. Champion Fiberglass, Inc.
3. Cooper B-Line, Inc.

C. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass channel with inturned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.5 THERMAL-HANGER SHIELD INSERTS

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

1. Carpenter & Paterson, Inc.
2. National Pipe Hanger Corporation.
3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

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

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and

waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

Q. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension

of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

End of Section

Section 22 11 16

DOMESTIC WATER PIPING

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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Do not interrupt water service without **Architect's**, **Construction Manager's**,

and **Owner's** written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61-Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

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

   a. Viega; Plumbing and Heating Systems.

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze fitting with stainless-steel grip ring and EPDM-rubber, O-ring seal in each end.

H. Appurtenances for Grooved-End Copper Tubing:

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

a. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

H. Appurtenances for Grooved-End, Ductile-Iron Pipe:

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

   a. Shurjoint Piping Products.
   b. Star Pipe Products.
   c. Victaulic Company.

2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

   a. AWWA C606 for ductile-iron-pipe dimensions.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.
   e. Minimum Pressure Rating:

      1) NPS 14 to NPS 18: **250 psig**.
      2) NPS 20 to NPS 46: **150 psig**.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

Bltn 3

~~I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~J.~~I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

~~K.~~J. 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.

~~L.~~K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

~~M.~~L. Install piping to permit valve servicing.

~~N.~~M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

~~O.~~N. Install piping free of sags and bends.

~~P.~~O. Install fittings for changes in direction and branch connections.

~~Q.~~P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

~~R.~~Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

~~S.~~R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

~~T.~~S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

~~U.~~T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~V.~~U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~W.~~V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 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 pipes, tubes, 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

I. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

Bltn 3

~~A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~B.~~A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

~~C.~~B. Support vertical piping and tubing at base and at each floor.

~~D.~~C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

~~E.~~D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

~~F.~~E. Install supports for vertical copper tubing every 10 feet.

~~G.~~F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

~~H.~~G. Install supports for vertical steel piping every 15 feet.

~~I.~~H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

~~J.~~I. Install supports for vertical stainless-steel piping every 15 feet.

~~K.~~J. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

~~L.~~K. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

~~M.~~L. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

~~N.~~M. Install supports for vertical PVC piping every 48 inches.

~~O.~~N. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

~~P.~~O. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

~~Q.~~P. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return

piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
3. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

F. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

G. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; Copper Pressure-Seal-Joint Fittings; and press joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

End of Section

Section 22 13 16

SANITARY WASTE AND VENT PIPING

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. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.3 PERFORMANCE REQUIREMENTS

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

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

Bltn 3 ~~B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.~~

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

C. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify [**Owner**] no fewer than [**two**] days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without [**Owner's**] written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

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

   a. ANACO-Husky.
   b. Fernco Inc.
   c. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

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

   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Solder: ASTM B 32, lead-free with ASTM B 813, water-flushable flux.

2.6 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.7 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer 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. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.8 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:

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

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

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

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

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

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) EBAA Iron, Inc.
4) JCM Industries, Inc.
5) Romac Industries, Inc.
6) Smith-Blair, Inc.; a Sensus company.
7) The Ford Meter Box Company, Inc.
8) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Carbon steel
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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

1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Hart Industries International, Inc.
4) Jomar International Ltd.
5) McDonald, A. Y. Mfg. Co.
6) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
7) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

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

        1) Capitol Manufacturing Company.
        2) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        3) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.
        3) Pressure Rating: 150 psig.
        4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

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

        1) Advance Products & Systems, Inc.
        2) Calpico, Inc.
        3) Pipeline Seal and Insulator, Inc.

    b. Description:

        1) Nonconducting materials for field assembly of companion flanges.
        2) Pressure Rating: 150 psig.
        3) Gasket: Neoprene or phenolic.
        4) Bolt Sleeves: Phenolic or polyethylene.
        5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

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

        1) Elster Perfection.
        2) Grinnell Mechanical Products.
        3) Precision Plumbing Products, Inc.
        4) Victaulic Company.

    b. Description:

        1) Standard: IAPMO PS 66
        2) Electroplated steel nipple.
        3) Pressure Rating: 300 psig at 225 deg F.
        4) End Connections: Male threaded or grooved.
        5) Lining: Inert and noncorrosive, propylene.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements 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.

Bltn 3

~~J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~K.~~J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

~~L.~~K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

~~M.~~L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

~~N.~~M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

~~O.~~N. Install steel piping according to applicable plumbing code.

~~P.~~O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

~~Q.~~P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

~~R.~~Q. Install aboveground ABS piping according to ASTM D 2661.

~~S.~~R. Install aboveground PVC piping according to ASTM D 2665.

~~T.~~S. Install underground ABS and PVC piping according to ASTM D 2321.

~~U.~~T. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

~~V.~~U. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to

sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

~~W.~~V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

~~X.~~W. Install force mains at elevations indicated.

~~Y.~~X. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

~~Z.~~Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

~~AA.~~Z. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~BB.~~AA. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~CC.~~BB. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. 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.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

    a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

Bltn 3

~~A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~B.~~A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

~~C.~~B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

~~D.~~C. Support vertical piping and tubing at base and at each floor.

~~E.~~D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

~~F.~~E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

~~G.~~F. Install supports for vertical cast-iron soil piping every 15 feet.

~~H.~~G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

~~I.~~H. Install supports for vertical steel piping every 15 feet.

~~J.~~I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

~~K.~~J. Install supports for vertical stainless-steel piping every 10 feet.

~~L.~~K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.

5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

~~M.~~L. Install supports for vertical copper tubing every 10 feet.

~~N.~~M. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

~~O.~~N. Install supports for vertical ABS and PVC piping every 48 inches.

~~P.~~O. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air

throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI standard-duty hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings**.**

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI standard-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 4: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:

1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:

1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Pressure transition couplings if dissimilar pipe materials.

End of Section

Section 22 14 13

FACILITY STORM DRAINAGE PIPING

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. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Section 221429 "Sump Pumps" for storm drainage pumps.
2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 PERFORMANCE REQUIREMENTS

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

1. Storm Drainage Piping: 10-foot head of water.
2. Storm Drainage, Force-Main Piping: 150 psig.

Bltn 3 ~~B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.~~

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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. Shop Drawings: For roof drainage system. Include calculations, plans, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

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

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify [**Owner**] no fewer than [**two**] days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without [**Owner's**] written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

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

   a. ANACO-Husky.
   b. Fernco Inc.
   c. MIFAB, Inc.
   d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

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

   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. MIFAB, Inc.
   d. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

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

   a. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight. Include square-cut-grooved or threaded ends matching joining method.

B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12 threaded.

C. Steel-Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.5 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer 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. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Non-pressure Transition Couplings:

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

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

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

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-

resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

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

      1) Cascade Waterworks Mfg. Co.
      2) Dresser, Inc.
      3) EBAA Iron, Inc.
      4) Ford Meter Box Company, Inc. (The)
      5) JCM Industries, Inc.
      6) Romac Industries, Inc.
      7) Smith-Blair, Inc.; a Sensus company.
      8) Viking Johnson; c/o Mueller Co.

   b. Standard: AWWA C219.
   c. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
   d. Center-Sleeve Material: Carbon steel.
   e. Gasket Material: Natural or synthetic rubber.
   f. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from 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.

Bltn 3 ~~J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~K.~~J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

~~L.~~K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

~~M.~~L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: Slope downward in direction of flow for piping as required by code and per authority having jurisdiction.

~~N.~~M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

~~O.~~N. Install steel piping according to applicable plumbing code.

~~P.~~O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

~~Q.~~P. Install aboveground ABS piping according to ASTM D 2661.

~~R.~~Q. Install aboveground PVC piping according to ASTM D 2665.

~~S.~~R. Install underground PVC piping according to ASTM D 2321.

~~T.~~S. Install engineered [**controlled-flow**] [**siphonic**] drain specialties and storm drainage piping in locations indicated.

~~U.~~T. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

~~V.~~U. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

~~W.~~V. Install force mains at elevations indicated.

~~X.~~W. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

~~Y.~~X. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

~~Z.~~Y. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~AA.~~Z. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

~~BB.~~AA. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. 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.

E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.
3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
4. In Underground Force-Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

Bltn 3 ~~A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."~~

~~B.~~A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

~~C.~~B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

~~D.~~C. Support vertical piping and tubing at base and at each floor.

~~E.~~D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

~~F.~~E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings

is limited to 60 inches.

~~G.~~F. Install supports for vertical cast-iron soil piping every 15 feet.

~~H.~~G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

~~I.~~H. Install supports for vertical steel piping every 15 feet.

~~J.~~I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inchrod.

~~K.~~J. Install supports for vertical copper tubing every 10 feet.

~~L.~~K. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

~~M.~~L. Install supports for vertical PVC piping every 48 inches.

~~N.~~M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.
3. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Connect force-main piping to the following:

1. Storm Sewer: To exterior force main.
2. Sump Pumps: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit

separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.

C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.

D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Extra Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:

1. [**Extra Heavy**] [**Service**] class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, copper pressure fittings, and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be any of the following:
1. Galvanized-steel pipe, pressure fittings, and threaded joints.
2. Fitting-type transition couplings if dissimilar pipe materials.

H. Underground storm drainage force mains NPS 4 and smaller shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

I. Underground storm drainage force mains NPS 5 and larger shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.

End of Section

Section 23 05 48

Bltn 3 VIBRATION ~~AND SEISMIC~~ CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Isolation pads.
2. Isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Restraining braces and cables.
11. Steel and inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

Bltn 3
B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
~~1.~~2. Vibration Isolation Base Details: Detail fabrication including

Bltn 3

anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

~~B.~~C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
   a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

Bltn 3

~~4. Seismic Restraint Details:~~
   ~~a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.~~
   ~~b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.~~
   ~~c. Coordinate seismic restraint and vibration isolation details with wind restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.~~
   ~~d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).~~

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

Bltn 3

B. Submit under provision of General Conditions and Division 1 as applicable.

C. Maintenance Data: Include adjustment instructions.

~~A.~~D. Submit manufacturer's installation instructions.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

Bltn 3

~~B. Comply with seismic restraint requirements in the IBC unless requirements in this Section are more stringent.~~

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

C. Reference Standards:
1. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
"Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems"
2. Codes and Standards for Noise Control:
a. ADC 1062R-4 Air Diffusion Council: Certification Rating and Test Manual
b. ANSI S1.13 American National Standards Institute: Measurement of Sound Pressure Levels
c. ARI 575 American Refrigeration Institute: Measurement of Sound in Equipment Rooms
d. ARI 443 American Refrigeration Institute: Standard of Sound Rating of Fan Coil Air Conditioners
e. ASHRAE 36-72 American Society of Heating, Refrigeration and Air

Bltn 3

Conditioning Engineers: Determination of Ventilating Equipment Sound Power.

f. AMCA 300 Air Moving and Control Association: Determination of Fan Sound Power Levels

g. ASTM E477 American Society for Testing and Materials: Test of Duct Lining and Silencer Performance

h. ASTM C423 American Society for Testing and Materials: Method for Measuring Sound Absorption

i. ASTM E90 American Society of Testing and Materials: Method for Measuring Sound Transmission Loss

j. ASTM E413 American Society of Testing and Materials: Determination of Sound Transmission Class

~~C.~~k. SMACNA Sheet Metal and Air Conditioning Contractors National Association

~~D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.~~

1.8 SUSTAINABLE DESIGN INTENT

A. Comply with project requirements intended to achieve sustainable design, measured and documented. Refer to Sections 018113, SUSTAINABLE DESIGN REQUIREMENTS and 018125 LIMITS FOR VOC CONTENT for additional requirements.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.

9. Vibration Mountings & Controls, Inc.
10. Or approved equal

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
   1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
   2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.
   1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
   2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
   1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
   6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at

rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.
9. Or Approved Equal.

D. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
1. Design Requirements: Lowest possible mounting height with not less

than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

E. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

Bltn 3

~~2.3 SEISMIC-RESTRAINT DEVICES~~

~~A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:~~

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

~~C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:~~
~~1. Amber/Booth Company, Inc.~~
~~2. California Dynamics Corporation.~~
~~3. Cooper B-Line, Inc.; a division of Cooper Industries.~~
~~4. Hilti, Inc.~~
~~5. Kinetics Noise Control.~~
~~6. Loos & Co.; Cableware Division.~~
~~7. Mason Industries.~~
~~8. TOLCO Incorporated; a brand of NIBCO INC.~~
~~9. Unistrut; Tyco International, Ltd.~~
~~10. Or Approved Equal.~~

D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

E. Snubbers: Factory fabricated using welded structural steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
   2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
   3. Maximum 1/4-inch air gap, and minimum 1/4-inch - thick resilient cushion.

F. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

G. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

H. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

I. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

J. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

K. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

L. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

M. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior

Bltn 3

~~applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.~~

~~2.4~~2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

Bltn 3

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

3.3 INSTALLATION

A. GENERAL:
   1. Install vibration isolation equipment in full accordance with the manufacturer's instructions.
   2. Suspend the vibration isolators supporting piping ductwork and

equipment from structural members.

3. Provide a minimum of 1 inch clearance between the building structure and vibration isolated supports, ducts, pipes, and equipment.
4. Provide 2 inch minimum clearance between the top of the housekeeping pad or floor and the underside of concrete inertial pads and/or steel equipment support frames.
5. Fasten all vibration isolators to the structure, not to floor diaphragms or lightweight components. Use bolts where holes are provided in the mounting flanges; otherwise, adhere using structural adhesive. Where mounting flanges are steel, use neoprene grommets and washers under anchor bolts. Where vibrating elements are to be fastened to structural elements provide connection details for review by Architect.
6. Do not use vibration isolation components to straighten or connect misaligned sections of piping or ductwork.
7. Align spring isolation hanger rods to clear the hanger box under all operating conditions.
8. Any bracing or supports for mechanical ductwork, piping, and equipment shall not bridge or reduce the effectiveness of vibration isolators.
9. Level vibration isolated equipment under rated design operating conditions while maintaining the isolation criteria. Isolators shall be plumb and aligned to preclude misalignment or undesired contact during operation

B. Vibration Isolation Schedule:

Equipment	Deflection	Isolator Class
Air handling unit fans (internal isolation)	2.0"	USM
Air handling units (typical external isolation)	0.125"	NP
Fans	2.0"	SH or USM
Base-mounted pumps and compressors, 5 hp and larger (provide inertia base)	2.0"	IB
Base-mounted pumps and compressors less than 5 hp	0.25"	NM
Other small pumps and motors (incl. inline pumps)	0.25	NM
Wall and exhaust fans less than ¼ hp	0.25"	NH or NM
All process and passive equipment attached to pump systems	0.25"	NM, SF
All mechanical room piping within the first 50-ft from rotating and reciprocating equipment	Same as attached equipment	
Piping Risers		RG
Transformers	0.25"	NM
Skid mounted equipment – Energy recover skid etc.	0.35"	NM
Dust Collector	0.3"	NM
Unit Heaters and FCU's	0.75"	SH

Water heaters	0.35"	FN

* Double layer NP isolation such as Mason Industry type WSW (or similar) with resilient hold-down assembly.

C. Miscellaneous Mechanical Equipment Isolation

1. Miscellaneous pieces of mechanical equipment, such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks, which are connected to isolated piping systems, shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection), unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Piping and Ductwork:

1. All piping within mechanical room connected to rotating and reciprocating equipment within 50 linear feet, shall be vibration isolated. Isolation devices shall be equivalent to that scheduled for the associated equipment.
2. Use trapezes for vertical support to horizontal piping only. Brace trapeze with an OSHPD pre-approved bracing system, or provide calculations demonstrating compliance with regulatory requirements.
3. No electrical conduit, fixture, ceiling suspension wires or other elements of the building construction attached to or abutted against the duct and piping systems.
4. Where ducts or piping penetrate walls, ceilings and floors of the occupied spaces, or ceiling void partitions or acoustically rated elements whether shown on the drawings or not, acoustically seal the penetration. See detail specified herein.
5. Contain rough-in of piping within stud wall cavities no less than 1/4-inch from the plane of the studs and 1 inch from gypsum board or other wall sheathing.
6. Install flexible connections at all connections to vibration isolated equipment, rotating, reciprocating and other vibrating equipment, and all pumps, whether isolated or not and at all air handlers whether internally isolated or not.
7. Vibration isolate all pipes except vents, gas and fire protection lines. Do not allow piping, plumbing or vent stacks to contact gypsum board.
8. Do not suspend plumbing or piping from ducts, conduits or related supports.
9. Provide flexible connectors in inlet and discharge piping systems for pumps having concrete inertial bases and where indicated on the Drawings.
10. Sheet metal band supports are not permitted on ducts suspended on vibration isolators. Use threaded rods, or other indicated support.
11. Do not suspend ducts from piping, plumbing, conduits or related supports.
12. Incorporate flexible connections in ductwork adjacent to all air moving units.
13. When equipment is in full operational condition, adjust the mounts to

ensure that the equipment is free floating, level and stable.

14. All equipment mounted on anti vibration mounts shall be connected to the adjacent ductwork or pipework system via a flexible connection positioned to avoid a direct connection between equipment and mounting surface.

~~B.~~15. Flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2" through 12" if the piping makes a 90º turn at the equipment. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure, 12" and larger sizes operating above 100 psi shall employ control cables with end fittings isolated by means of 1/2" thick bridge bearing neoprene washer bushings designed for maximum of 1000 psi.

~~C. Strength of Support and Seismic Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.~~

~~3.3 VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE INSTALLATION~~

~~A. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.~~

~~B. Equipment Restraints:~~

~~1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.~~

~~2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.~~

~~3. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.~~

~~C. Piping Restraints:~~

~~1. Comply with requirements in MSS SP-127.~~

~~2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.~~

~~3. Brace a change of direction longer than 12 feet.~~

~~D. Install cables so they do not bend across edges of adjacent equipment or building structure.~~

~~E. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.~~

~~F. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.~~

~~G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment mounting channels are attached to wall.~~

~~H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.~~

~~I. Drilled-in Anchors:~~

~~1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.~~

~~2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.~~

~~3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.~~

~~4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.~~

~~5. Set anchors to manufacturer's recommended torque, using a torque wrench.~~

~~6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.~~

~~3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION~~

~~A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.~~

~~3.5~~3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
   3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   6. Measure isolator restraint clearance.
   7. Measure isolator deflection.
   8. Verify snubber minimum clearances.
   9. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
   11. Test and adjust air-mounting system controls and safeties.
   12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

~~3.6~~3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust air-spring leveling mechanism.

D. Adjust active height of spring isolators.

E. Adjust restraints to permit free movement of equipment within normal mode of operation.

~~3.7~~3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Section 017900 "Demonstration and Training."

End of Section

VOLUME II - BINDER I

VOLUME II - BINDER II

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Avenue
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

STAMP

KEY PLAN

Construction Documents

ISSUED: **11/5/2021**

REVISIONS

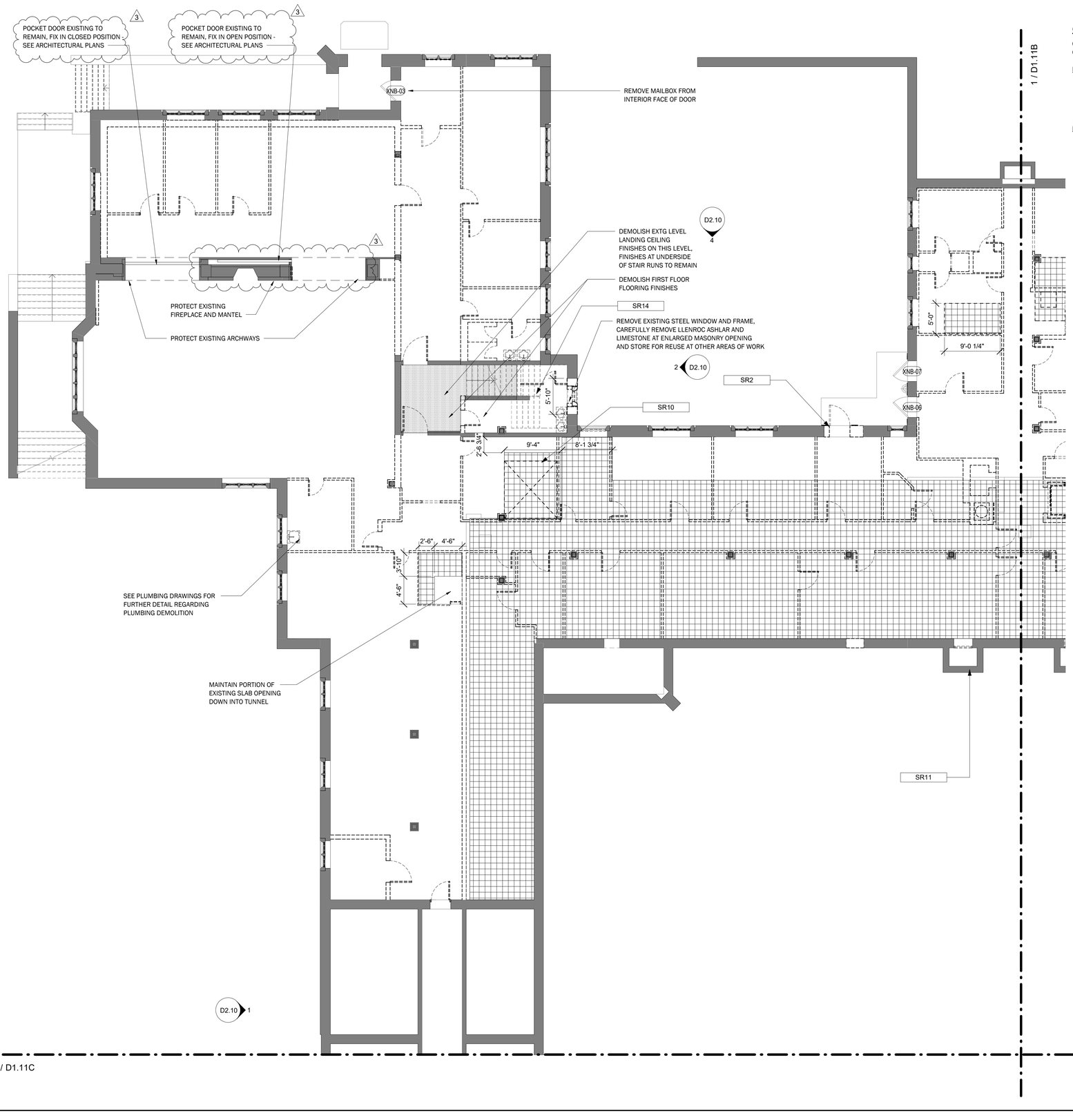
8/5/2022	BULLETIN #3	3

DRAWING LIST VOLUME II

GOODY CLANCY PROJECT NUMBER: 07400

DRAWN: Author DATE: 11/5/2021
CHECKED: Checker SCALE:

DRAWING NO.: 3 **X0.02**



OWNER SALVAGE SCHEDULE

CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF SALVAGED ITEMS. CONTRACTOR SHALL TURN OVER SALVAGED ITEMS TO THE OWNER.

ITEMS TO BE SALVAGED FOR STORAGE/USE OUTSIDE OF BALCH:

- FIRE ALARM PANELS - WITHIN EACH UNIT AND MAIN PANELS
- FIRE ALARM HORN STROBES
- FIRE EXTINGUISHERS
- SELECT FURNITURE - CORNELL TO IDENTIFY
- ALL WAP DEVICES
- AV EQUIPMENT

ITEMS TO BE SALVAGED FOR REUSE IN BALCH:

- BEDROOM ENTRY DOOR PANELS
  - PRESERVE ORIGINAL PAINTED DOOR NUMBERS
  - SALVAGE DOORS FROM ROOM 2517 AND 2269
  - SALVAGE 71 SOLID DOORS AND 20 MIRRORED DOORS
- SELECT LIGHTING FIXTURES - TO BE IDENTIFIED
- RESIDENT MAILBOXES

DEMOLITION GENERAL NOTES

1. GENERAL CONTRACTOR IS TO FIELD VERIFY ALL DIMENSIONS AND CONDITIONS IN THE FIELD, BOTH PRIOR TO DEMOLITION AND UPON COMPLETION OF DEMOLITION, AND NOTIFY ARCHITECT OF ANY DISCREPANCIES.
2. PROTECT THE EXISTING BUILDING ELEMENTS SCHEDULED TO REMAIN. REFER TO THE SPECIFICATIONS, INCLUDING BUT NOT LIMITED TO DIVISION 02 "SELECTIVE DEMOLITION" FOR ADDITIONAL PROTECTION REQUIREMENTS. THE CONSTRUCTION MANAGER IS RESPONSIBLE FOR REPAIR OR REPLACEMENT OF ANY DAMAGE TO EXISTING MATERIALS DURING DEMOLITION OR CONSTRUCTION TO MATCH ORIGINAL CONDITIONS AT NO ADDITIONAL COST TO THE OWNER; SUCH REPAIR AND REPLACEMENT BEING ADDITIONAL IS SUBJECT TO ARCHITECT'S APPROVAL AND THE CONSTRUCTION MANAGER'S WRITTEN PROPOSAL FOR SUCH WORK.
3. REFER TO THE SPECIFICATIONS, INCLUDING BUT NOT LIMITED TO DIVISION 01 SECTION "CONSTRUCTION WASTE MANAGEMENT" FOR REQUIREMENTS AFFECTING SORTING, SEPARATION, DISPOSAL, OR RECYCLING OF DEMOLISHED MATERIALS.
4. REMOVE ALL FINISHES, CEILINGS, LIGHTING, MEP/FP SYSTEMS, PARTITIONS, SIGNAGE, AND ASSOCIATED ACCESSORIES IN ALL AREAS EXCEPT AS NOTED AND IN HISTORIC LOUNGES AND STAIRS AS SHOWN. REFER TO SELECTIVE REMOVAL KEYNOTES ON ENLARGED DEMO PLANS FOR SCOPE OF DEMOLITION, REMOVAL, AND SALVAGE SCOPE IN THESE AREAS.
5. REFER TO MEP & FP DRAWINGS FOR EXTENT AND LOCATION OF EXISTING SERVICES DEMOLITION. CUT AND PATCH FINISHES AS REQUIRED FOR ACCESS.
6. EXISTING STRUCTURE AND CHIMNEYS TO REMAIN UNO., PROTECT. DEMOLITION PLANS INDICATE EXTENT OF FLOOR DEMOLITION. LOCAL EXTENTS OF SLAB DEMOLITION TO BE CONFIRMED IN THE FIELD. DIMENSIONS SHOWN ARE MIN. OPENING SIZES. OPENING MAY NEED TO BE ENLARGED DEPENDING ON LOCATION OF EXISTING CONCRETE RIBS. SEE STRUCTURAL TYPICAL DETAIL FOR OVERCUT AND INFILL IN THESE AREAS.
7. NOTIFY ARCHITECT IF ADDITIONAL CUTTING AND PATCHING IS REQUIRED TO ACCESS ITEMS INDICATED FOR DEMOLITION OR INSTALLATION OF NEW SYSTEMS.
8. SALVAGE ALL HISTORIC LIGHT FIXTURES AND OTHER HISTORIC ITEMS AS SHOWN.
9. SEE EXTERIOR ELEVATIONS FOR WINDOW REMOVAL AND REPLACEMENT INFORMATION.
10. REFER TO D1.07 AND D1.17 SERIES FOR DEMOLITION SCOPE AT ROOF.
11. SEE LANDSCAPE AND CIVIL DRAWINGS FOR EXTENT OF COURTYARD AND EXTERIOR LANDSCAPE DEMOLITION.
12. ALL UNUSED FLOOR AND WALL OPENINGS, WHETHER NEW OR EXISTING, SHALL BE INFILLED. ALL FLOOR OPENINGS MUST MEET FIRE RATINGS INDICATED ON LIFE SAFETY DRAWINGS. WALL OPENINGS, WHEN OCCURING IN RATED WALLS INDICATED ON THE LIFE SAFETY DRAWINGS, MUST MEET RATING REQUIRMENTS.
13. REFER TO SALVAGE SCHEDULE FOR ADDITIONAL ELEMENTS TO BE SALVAGED FOR REINSTALLATION OR TO TURNED OVER TO THE OWNER.
14. EXISTING PLASTER/GYPSUM/STUD INTERIOR PARTITION WALLS ARE NOT STRUCTURAL IN THE EXISTING BUILDING. SLABS TO BE INFILLED AS REQUIRED AFTER THE REMOVAL OF THE PLASTER AND LATH PARTITIONS.
15. FOR INTERIOR TERRACOTTA PARTITION WALLS THAT ARE TO BE DEMOLISHED, GC TO LOCALLY EXPOSE UNDERSIDE OF SLAB ABOVE AT TOP OF PARTITION WALL FOR OBSERVATION BY DESIGN TEAM BEFORE WALL IS DEMOLISHED.
16. DEMOLITION OF EXISTING FLOOR FINISH ASSEMBLIES (INCLUDING BUT NOT LIMITED TO TILE, CARPET, RESILIENT FLOORING) SHOULD INCLUDE THE SETTING BED/FLOOR LEVELING COMPOUNDS AND BE REMOVED DOWN TO STRUCTURAL SLAB.

SELECTIVE REMOVAL KEYNOTE LEGEND

SR1	DEMOLISH ALL MILLWORK AT WINDOWS AS REQUIRED FOR DEMOLITION OF EXISTING RADIATORS AND ASSOCIATED PIPING.
SR2	DEMOLISH PORTION OF EXISTING WALL TO CREATE NEW DOOR OPENING. REMOVE AND SALVAGE ANY ASSOCIATED WOOD PANELING FOR REUSE.
SR3	DEMOLISH EXISTING PLEXIGLASS FIREPLACE ENCLOSURE.
SR4	DEMOLISH PORTION OF EXISTING WALL AT STEAM PIPE CHASE AS REQUIRED TO DEMOLISH PIPING. TYPICAL AT ALL CHASES. REFER TO MEP DRAWINGS FOR EXTENT OF WORK.
SR5	DEMOLISH PORTION OF EXISTING WALL AS REQUIRED TO REMOVE EXISTING ELECTRICAL AND LOW VOLTAGE DEVICES AND CONDUIT.REFER TO ELECTRICAL AND IT DRAWINGS.
SR6	REMOVE AND SALVAGE EXISTING DOOR AND HARDWARE. EXISTING FRAMED OPENING TO REMAIN AS IS.
SR7	DEMOLISH PORTION OF EXISTING CEILING AND LIGHT FIXTURES. REMOVE AND SALVAGE ALL LIGHT FIXTURES.
SR8	DEMOLISH TOP +/- 2'-5" OF TUNNEL WALL WITHIN AREA OF NEW SLAB ABOVE.
SR9	REMOVE AND SALVAGE EXISTING LIGHT FIXTURE FOR REUSE
SR10	FRAME OPENING FOR NEW ELEVATOR AND DEMOLISH EXISTING SLAB WITHIN FOOTPRINT. REFER TO STRUCTURAL DRAWINGS.
SR11	EXISTING WINDOWS TO BE REMOVED AT WINDOW WELLS
SR12	REMOVE EXISTING ELEVATOR. REMOVE EXISTING SHAFT WALLS.
SR13	DORMER END WALLS TO REMAIN, DEMO KNEE WALLS BETWEEN DORMERS, TYPICAL ALL DORMERS U.N.O.
SR14	REMOVE EXISTING WALL MOUNTED HANDRAIL AND ASSOCIATED MOUNTING HARDWARE AT ALL RUNS, INTERMEDIATE LANDINGS, AND LEVEL LANDINGS.

DEFINITIONS

- DEMOLISH: REMOVE EXISTING ELEMENT(S) AND DISCARD; ELEMENT IS NOT TO REMAIN AS PART OF THE COMPLETED WORK; SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS REGARDING MATERIALS WASTE HANDLING AND RECYCLING.
- REMOVE: ELEMENT WILL NOT REMAIN AS PART OF THE COMPLETED WORK; SALVAGE AS A COMPLETE BUILDING ELEMENT INTENDED FOR RECYCLING/REUSE AS DIRECTED BY OWNER.
- SALVAGE: CAREFULLY REMOVE EXISTING ELEMENT(S) OR ASSEMBLY WITHOUT DAMAGE; ELEMENT IS TO REMAIN AS PART OF THE COMPLETED WORK AND MUST BE REINSTALLED. CONTRACTOR TO TAG AND LABEL SALVAGED ELEMENTS TO ENSURE REINSTALLATION IN ORIGINAL LOCATION.

DEMOLITION LEGEND

- SLAB REMOVAL, SEE STRUCTURAL
- PROTECT HISTORIC FINISHES. PATCH AND REPAIR AS REQUIRED AFTER HVAC INSTALLATION
- PROTECT ALL EXISTING STAIR ELEMENTS AND FINISHES, UNO.
- EXISTING INACCESSIBLE AREA
- AREA TO BE EXCAVATED
- CEILING AREA TO BE DEMOLISHED
- ATTIC SPACE, NO SLAB
- LIMITED DEMOLITION SCOPE IN TATKON CENTER (REFER TO D4.03 AND D4.04) and RHD APARTMENT (REFER TO D4.05)
- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- CREATE OPENING IN EXISTING WALL
- EXISTING DOOR AND FRAME TO BE REMOVED
- EXISTING DOOR TO BE REMOVED, PROTECT FRAME TO REMAIN
- EXISTING DOOR TO REMAIN, PROTECT; MODIFY HARDWARE AS SCHEDULED
- EXISTING WINDOW SASH TO BE REMOVED. LIMESTONE MULLIONS AND SURROUND TO REMAIN, PROTECT.

1 / D1.11A — 1ST FLOOR DEMOLITION - A
Scale: 1/8" = 1'-0"

Cornell University
FOUNDED A.D. 1865

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

BALCH HALL RENOVATION

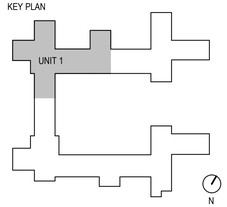
Cornell University

600 Thurston Avenue
Ithaca, New York 14853

CONSULTANT

STAMP

KEY PLAN



Construction Documents

ISSUED: **11/5/2021**

REVISIONS

8/5/2022	BULLETIN #3	3

ENLARGED FIRST FLOOR DEMO PLAN - A

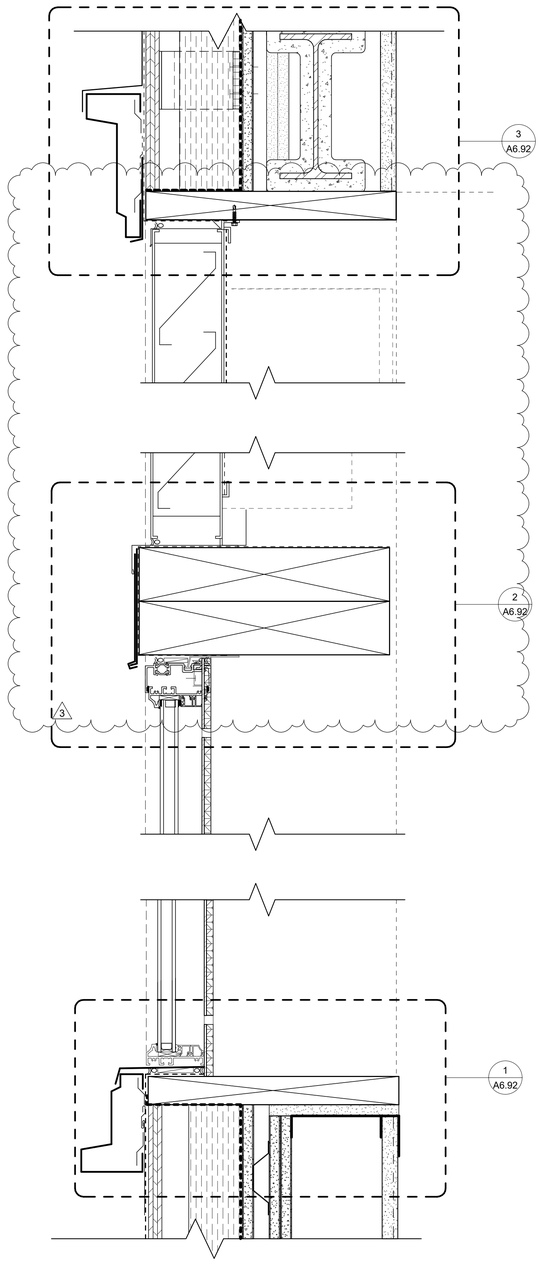
GOODY CLANCY PROJECT NUMBER: 07400

DRAWN:	Author	DATE:	11/5/2021
CHECKED:	Checker	SCALE:	As indicated

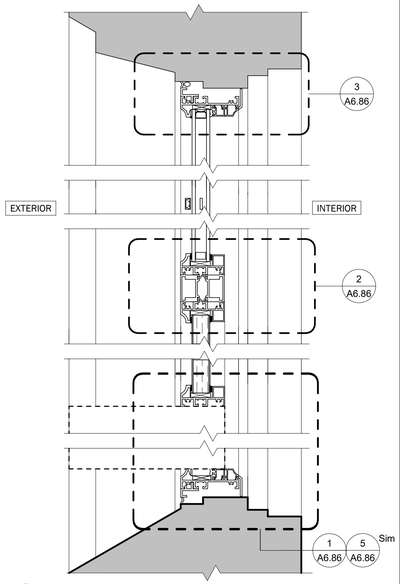
DRAWING NO.:

D1.11A

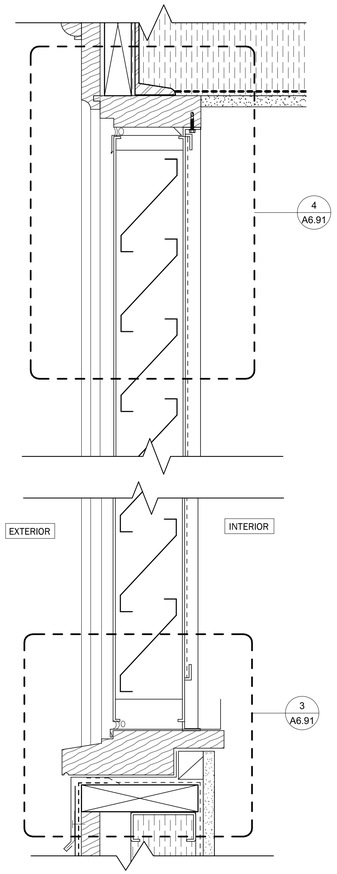
8/3/2022 3:32:11 PM
C:\Users\shannon.fay\OneDrive - Goody, Clancy & Associates\Documents\00-Revit-Local\ARCH_07400-Cornell-Balch_R2021-CENTRAL_shannon.fay75PQ4.rvt



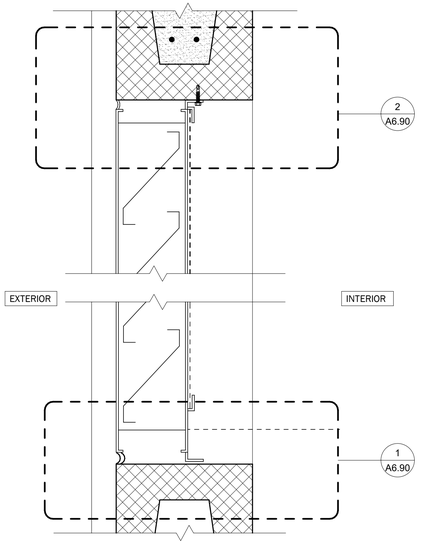
7 A6.82 WINDOW AT ELEVATOR PENTHOUSE - SECTION
Scale: 3" = 1'-0"



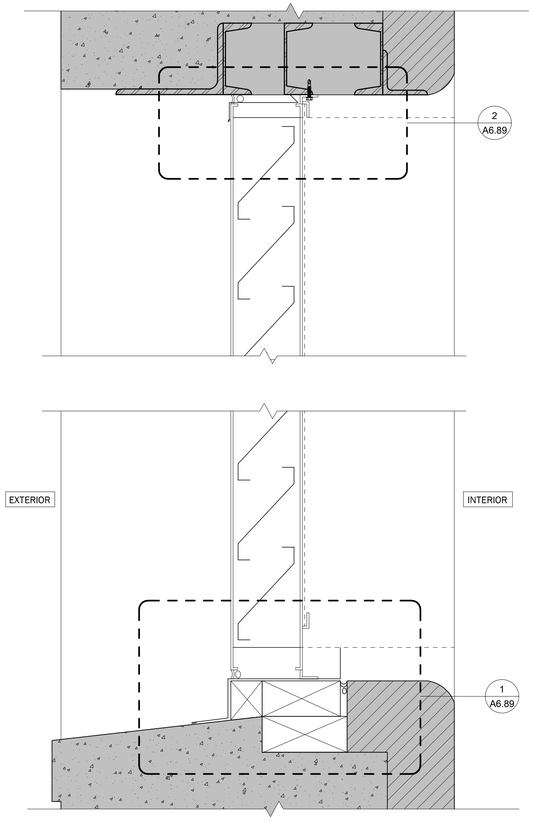
6 A6.82 FIXED WINDOW AT AC UNIT - SECTION
Scale: 3" = 1'-0"



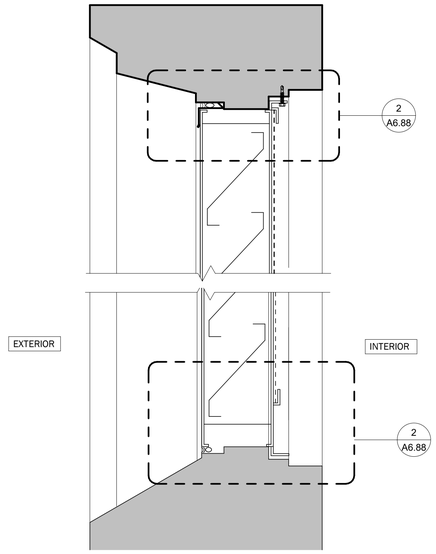
5 A6.82 LOUVER AT MECHANICAL DORMER - SECTION
Scale: 3" = 1'-0"



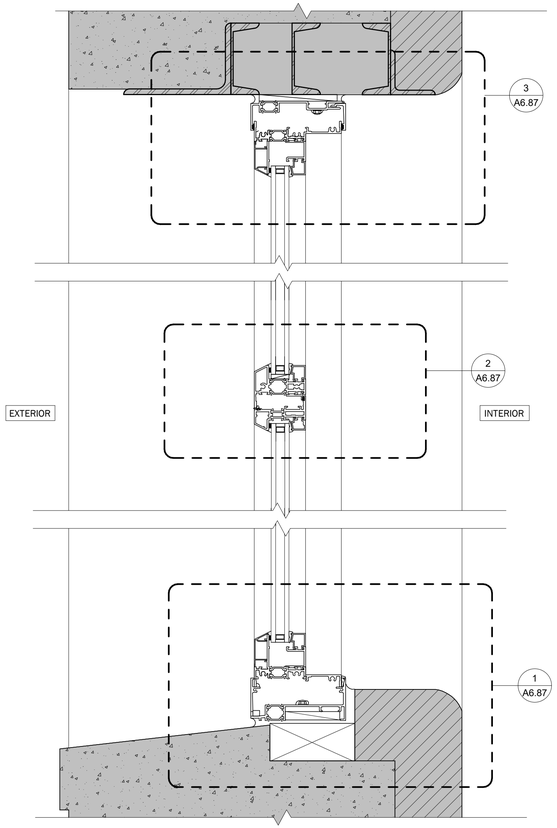
4 A6.82 LOUVER AT TUNNEL - SECTION
Scale: 3" = 1'-0"



3 A6.82 LOUVER AT AREAWAY - SECTION
Scale: 3" = 1'-0"



2 A6.82 LOUVER AT STONE SURROUND- SECTION
Scale: 3" = 1'-0"



1 A6.82 WINDOW AT AREAWAY - SECTION
Scale: 3" = 1'-0"

BALCH HALL RENOVATION

Cornell University

600 Thurston Avenue
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

STAMP

KEY PLAN

Construction Documents

ISSUED: **11/5/2021**

REVISIONS

8/5/2022	BULLETIN #3	3

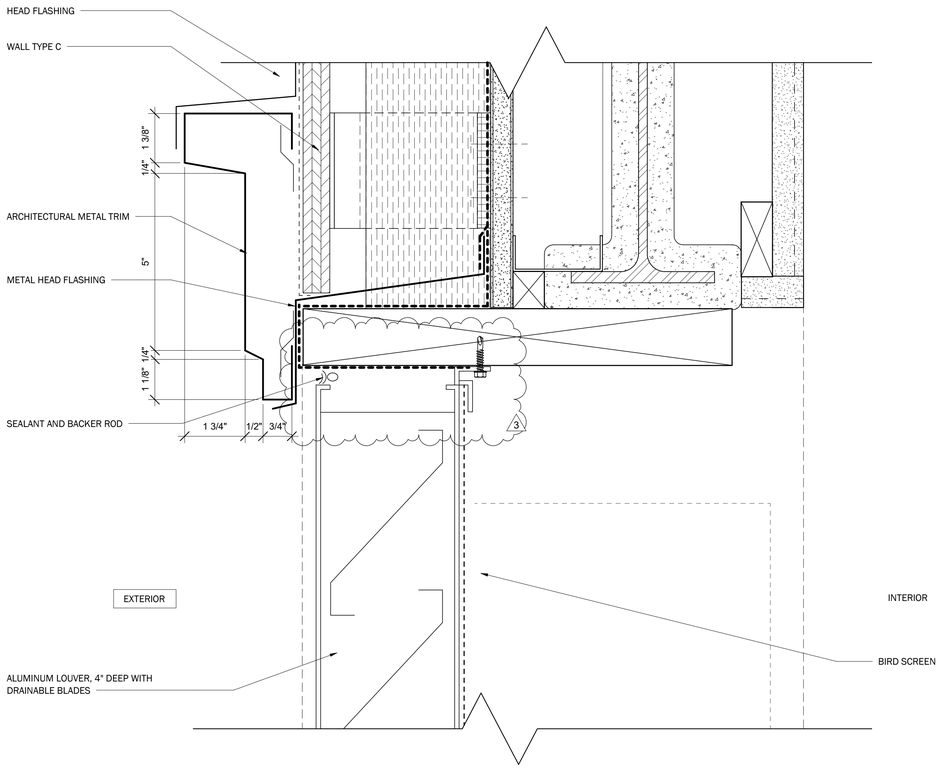
WINDOW AND LOUVER DETAILS - OVERALL

GOODY CLANCY PROJECT NUMBER: 07400

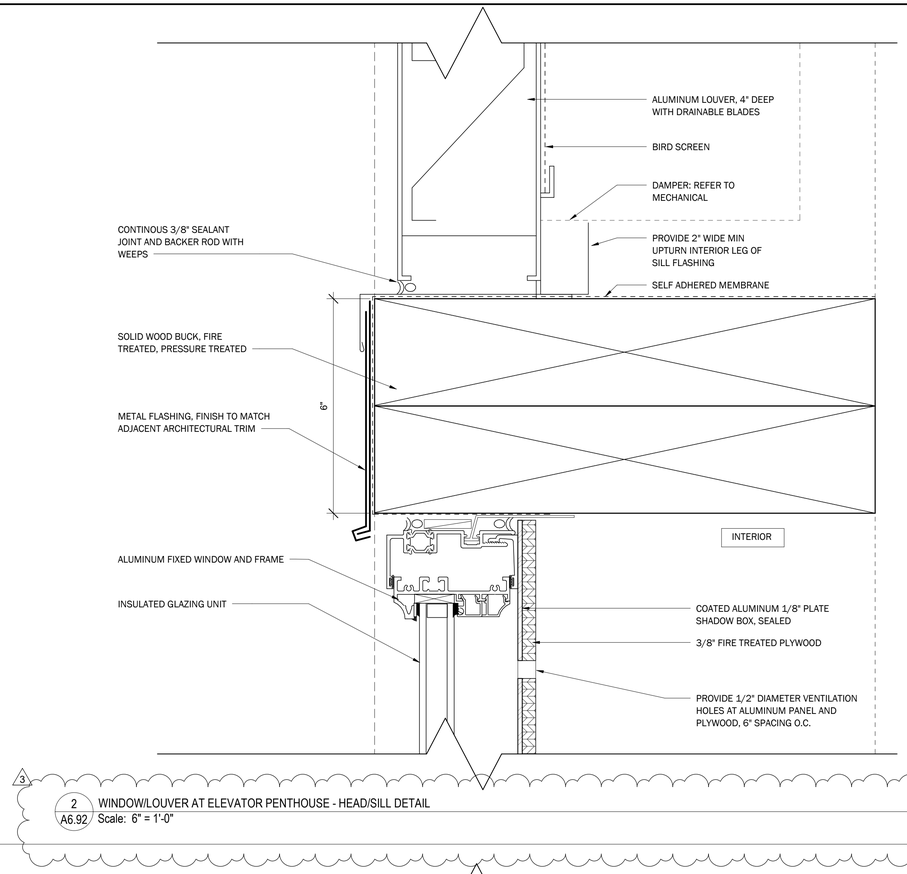
DRAWN:	MTB	DATE:	11/5/2021
CHECKED:	JV	SCALE:	3" = 1'-0"

DRAWING NO.:

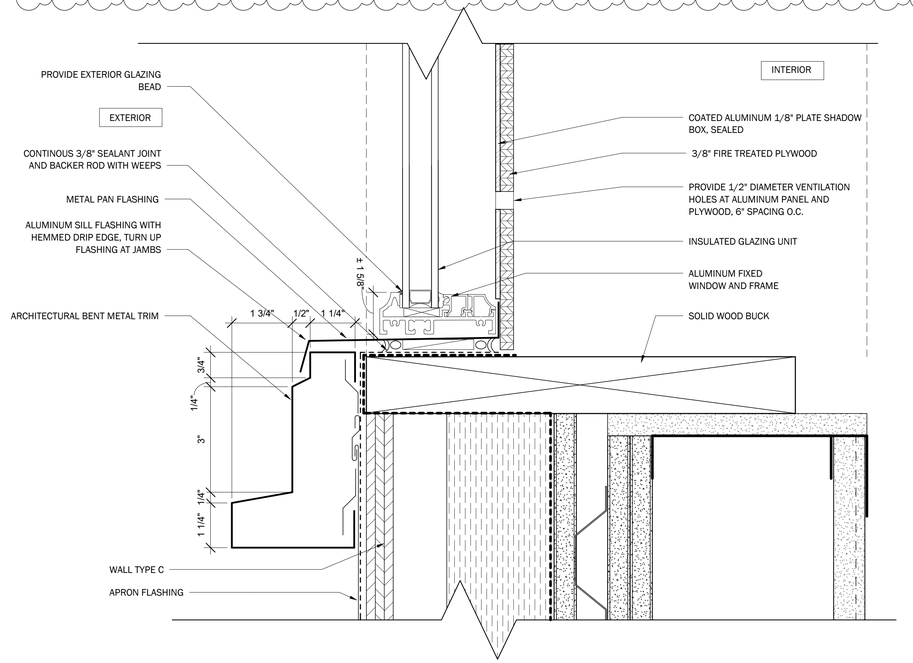
A6.82



3 LOUVER AT ELEVATOR PENTHOUSE - HEAD DETAIL
A6.92 Scale: 6" = 1'-0"



3
2 WINDOW/LOUVER AT ELEVATOR PENTHOUSE - HEAD/SILL DETAIL
A6.92 Scale: 6" = 1'-0"



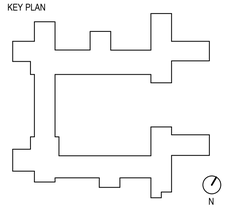
1 WINDOW/LOUVER AT ELEVATOR PENTHOUSE - SILL DETAIL
A6.92 Scale: 6" = 1'-0"

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

STAMP

KEY PLAN



BALCH HALL RENOVATION

Cornell University

600 Thurston Avenue
Ithaca, New York 14853

Construction Documents

ISSUED: **11/5/2021**

REVISIONS

8/5/2022	BULLETIN #3	3

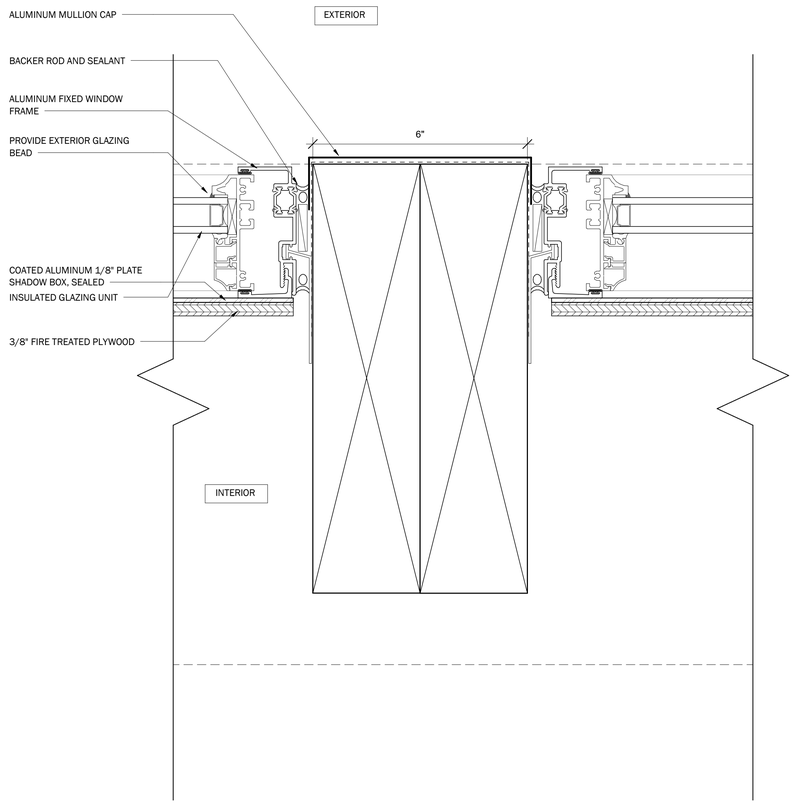
WINDOW AND LOUVER DETAILS - ELEVATOR PENTHOUSE

GOODY CLANCY PROJECT NUMBER: 07400

DRAWN:	MTB	DATE:	11/5/2021
CHECKED:	JV	SCALE:	6" = 1'-0"

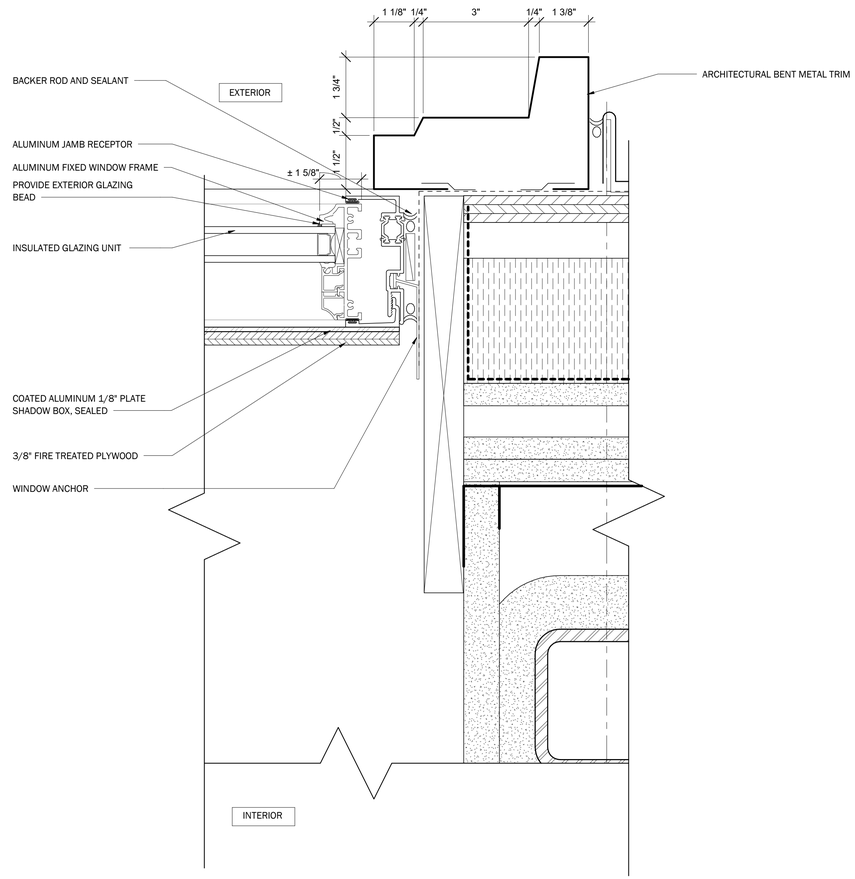
DRAWING NO.:

A6.92



3

2 WINDOW AT ELEVATOR PENTHOUSE - MULLION
A6.93 Scale: 6" = 1'-0"



1 WINDOW AT ELEVATOR PENTHOUSE - JAMB
A6.93 Scale: 6" = 1'-0"

BALCH HALL RENOVATION

Cornell University

600 Thurston Avenue
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

STAMP

KEY PLAN

N

Construction Documents

ISSUED: **11/5/2021**

REVISIONS

8/5/2022	BULLETIN #3	3

WINDOW AND LOUVER DETAILS - ELEVATOR PENTHOUSE

GOODY CLANCY PROJECT NUMBER: 07400

DRAWN:	PNC	DATE:	11/5/2021
CHECKED:	JV	SCALE:	6" = 1'-0"

DRAWING NO.:

A6.93

PUMP SCHEDULE

ITEM												MOTOR DATA						VIBRATION ISOLATION				
TYPE	NO.	MANUFACTURER	MODEL NO.	LOCATION	SYSTEM SERVED	FLUID SYSTEM	FLOW [GPM]	MIN PUMP FLOW [GPM]	PUMP HEAD [FT WC]	PUMP [RPM]	PUMP EFFICIENCY AT DESIGN CONDITION %	NPSH	BHP	HP	V	PH	HZ	SPEED CONTROL	MOUNT TYPE	MIN. STATIC DEFL. (IN)	BASE TYPE	OPERATING WEIGHT (LBS)	NOTES
CHWP	1	BELL AND GOSSETT	E1510-3BD	L2 S MECH ROOM	CHW-DUTY	WATER	465.0	98.5	70	1644	84	6.62	9.72	15.0	208	3	60	VFD	SPRING	2"	INERTIA	772	1, 2, 4
CHWP	2	BELL AND GOSSETT	E1510-3BD	L2 S MECH ROOM	CHW-STANDBY	WATER	465.0	98.5	70	1644	84	6.62	9.72	15.0	208	3	60	VFD	SPRING	2"	INERTIA	772	1, 2, 4
CHWP	3	BELL AND GOSSETT	E-90-1.25AAB	L2 S MECH ROOM	CHW PART LOAD BOOSTER	WATER	55.0	8.8	40	2350	67	9.61	0.87	5.0	208	3	60	ECM	SPRING HANGER	2"	NONE	63	1 TO 3
GWP	1	BELL AND GOSSETT	E1510-1.5BC	L2 S MECH ROOM	GLYCOL HHW-DUTY	40% PROPYLENE GLYCOL	170.0	25.0	100	1726	62	6.2	6.90	10.0	208	3	60	VFD	SPRING	2"	INERTIA	297	1, 2, 4
GWP	2	BELL AND GOSSETT	E1510-1.5BC	L2 S MECH ROOM	GLYCOL HHW-STANDBY	40% PROPYLENE GLYCOL	170.0	25.0	100	1726	62	6.2	6.90	10.0	208	3	60	VFD	SPRING	2"	INERTIA	297	1, 2, 4
HCP	1	BELL AND GOSSETT	ECOCIRC XL 36-45	L1 N MECH ROOM	GLYCOL HEATING COIL PUMP - ERV-1	40% PROPYLENE GLYCOL	18.7	18.7	15	3089	41	0	0.18	0.2	120	1	60	ECM	SPRING HANGER	1"	NONE	16	1 TO 3
HCP	2	BELL AND GOSSETT	ECOCIRC XL 36-45	L2 S MECH ROOM	GLYCOL HEATING COIL PUMP - ERV-2	40% PROPYLENE GLYCOL	12.0	12.0	20	3399	33	0	0.19	0.2	120	1	60	ECM	SPRING HANGER	1"	NONE	16	1 TO 3
HCP	3	BELL AND GOSSETT	ECOCIRC XL 20-35	L1 N MECH ROOM	GLYCOL HEATING COIL PUMP - LAUNDRY N	40% PROPYLENE GLYCOL	12.8	12.8	10	2477	36	0	0.09	0.1	120	1	60	ECM	SPRING HANGER	1"	NONE	16	1 TO 3
HCP	4	BELL AND GOSSETT	ECOCIRC XL 20-35	TATKON MECH ROOM	GLYCOL HEATING COIL PUMP - LAUNDRY S	40% PROPYLENE GLYCOL	10.3	10.3	10	2432	33	0	0.08	0.1	120	1	60	ECM	SPRING HANGER	1"	NONE	16	1 TO 3
HCP	5	BELL AND GOSSETT	ECOCIRC XL 36-45	TATKON MECH ROOM	GLYCOL HEATING COIL PUMP - TATKON AHU	40% PROPYLENE GLYCOL	21.9	21.9	10	2806	39	0	0.15	0.2	120	1	60	ECM	SPRING HANGER	1"	NONE	16	1 TO 3
HHWP	1	BELL AND GOSSETT	E1510-2BD	L2 S MECH ROOM	HIGH TEMPERATURE HHW-DUTY	WATER	257.0	35.0	60	1650	74	4.25	3.16	5.0	208	3	60	VFD	SPRING	2"	INERTIA	272	1, 2, 4
HHWP	2	BELL AND GOSSETT	E1510-2BD	L2 S MECH ROOM	HIGH TEMPERATURE HHW-STANDBY	WATER	257.0	35.0	60	1650	74	4.25	3.20	5.0	208	3	60	VFD	SPRING	2"	INERTIA	272	1, 2, 4
HHWP	3	BELL AND GOSSETT	E1510-2.5BB	L2 S MECH ROOM	LOW TEMPERATURE HHW-DUTY	WATER	200.0	47.6	60	1563	75	5.44	3.97	7.5	208	3	60	VFD	SPRING	2"	INERTIA	367	1, 2, 4
HHWP	4	BELL AND GOSSETT	E1510-2.5BB	L2 S MECH ROOM	LOW TEMPERATURE HHW-STANDBY	WATER	200.0	47.6	60	1563	75	5.44	3.97	7.5	208	3	60	VFD	SPRING	2"	INERTIA	367	1, 2, 4

NOTES:

1. ALL CONTROL WIRING, RELAYS, MISCELLANEOUS DEVICES SHALL BE BY MECHANICAL CONTRACTOR.
2. PROVIDE VIBRATION ISOLATION PER SPECIFICATION 230548.
3. PROVIDE W/ INTEGRAL EC MOTOR & CONTROLLER
4. PROVIDE REXNORD OMEGA COUPLING

STEAM CONDENSATE PUMP SCHEDULE

ITEM						DISCHARGE			RECEIVER	ELECTRICAL DATA				EMERGENCY/	OPERATING	
TYPE	NO.	MANUFACTURER	MODEL	LOCATION	TYPE	[GPM]	HEAD [PSIG]	NPSH [PSIG]	TEMP [°F]	[GAL]	HP	V	PH	HZ	STANDBY POWER	WEIGHT [LBS]	NOTES
SCP	1 & 2	BELL AND GOSSETT	52CB-45-20	MECH.20065	CENTRIFUGAL - DUPLEX	45	20	2	210	23	1.5	120	1	60	-	650	ALL NOTES

NOTES:

1. PACKAGE SHALL BE SINGLE POINT CONNECTION WITH DISCONNECT MOUNTED.
2. EACH PACKAGE PUMPS ARE WORKING ON DUTY AND STANDBY.

PLATE HEAT EXCHANGER SCHEDULE

ITEM					PRIMARY SIDE					SECONDARY SIDE					HEAT TRANSFER	OPERATING	
TYPE	NO.	MANUFACTURER	MODEL NO.	SERVICE	FLOW [GPM]	FLUID SYSTEM	EWT [°F]	LWT [°F]	PD [FT WC]	FLOW [GPM]	FLUID SYSTEM	EWT [°F]	LWT [°F]	PD [FT WC]	AREA [SF]	WEIGHT [LBS]	NOTES
HX	1	ALFA LAVAL	AQ2T-BFG	GLYCOL LOOP	40	WATER	180	105	3	105	40% PROPYLENE GLYCOL	100	130	22	89	363	1,2
HX	2	ALFA LAVAL	AQ2T-PFG	HEATING HOT WATER LOOP	92	WATER	180	105	5	224	WATER	100	130	17	149	494	1,2

NOTES:

1. 125 PSIG PRESSURE RATING
2. MILD STEEL FRAME PLATE, EPOXY COATED NOZZLES AND PIPING, 316 STAINLESS STEEL PLATES & NITRILE GASKETS

EXPANSION TANK SCHEDULE

ITEM								TANK SIZE		INITIAL	MAX OPERATING PRESSURE			
TYPE	NO.	MANUFACTURER	SERVES	TYPE	FLUID SYSTEM	TANK VOLUME [GAL]	SYSTEM TEMP RANGE [°F]	ACCEPTANCE VOLUME [GAL]	DIA [IN]	LENGTH [IN]	PRESSURE AT TANK [PSIG]	RELIEF VALVE [PSIG]	AT TANK [PSIG]	OPERATING WEIGHT [LBS]	NOTES
ET	1	BELL AND GOSSETT	HIGH TEMPERATURE HHW	DIAPHRAGM	WATER	100.0	100	25.0	30"	50 5/8"	80	100	125	525	1,2,3
ET	2	BELL AND GOSSETT	GLYCOL LOOP	DIAPHRAGM	WATER	57.0	100	15.0	20"	58 7/8"	80	100	125	290	1,2,3
ET	3	BELL AND GOSSETT	HEATING HOT WATER	DIAPHRAGM	WATER	57.0	100	15.0	20"	58 7/8"	80	100	125	290	1,2,3

NOTES:

1. FILL VALVE SIZED TO ACCOMMODATE 5 PSIG AT THE TOP OF SYSTEM STARTUP.
2. WEIGHT LISTED IS AT 100% FULL.
3. 125 PSI DESIGN PRESSURE

AIR SEPARATOR SCHEDULE

ITEM												
TYPE	NO.	MANUFACTURER	MODEL NO.	LOCATION	SERVICE	TYPE	PIPE CONN SIZE [IN]	REQUIRED CAPACITY [GPM]	AIR REMOVAL %	FLUID SYSTEM	PRESSURE DROP [FT WG]	DESIGN PRESSURE [PSI]	OPERATING WEIGHT [LBS]	NOTES
AS	1	BELL AND GOSSETT	CRS-4F	MEP ROOM	HIGH TEMPERATURE HHW	COALESCING REMOVAL SEPERATOR	4"	133	60	WATER	0.35	150	245	1,2
AS	2	BELL AND GOSSETT	CRS-4F	MEP ROOM	GLYCOL LOOP	COALESCING REMOVAL SEPERATOR	4"	105	60	WATER/GLYCOL	0.2	150	245	1,2
AS	3	BELL AND GOSSETT	CRS-4F	MEP ROOM	HEATING HOT WATER	COALESCING REMOVAL SEPERATOR	4"	224	100	WATER	1	150	245	1,2

NOTES:

1. PROVIDE W/ INTEGRAL AIR VENT & DRAIN.
2. WEIGHT LISTED IS FLOODED WEIGHT.

CHEMICAL POT FEEDER SCHEDULE

ITEM								
TYPE	NO.	MANUFACTURER	LOCATION	SERVICE	CAPACITY [GAL]	FLUID SYSTEM	DESIGN PRESSURE [PSI]	OPERATING WEIGHT [LBS]	NOTES
CPF	1	WESSELS	MEP ROOM	HHW	5	WATER	80.00	50	

STEAM HEAT EXCHANGER SCHEDULE

ITEM						PRIMARY SIDE				SECONDARY SIDE					
TYPE	NO.	MANUFACTURER	MODEL	LOCATION	LOAD [BTU/HR]	FLUID SYSTEM	MAXIMUM PRESSURE DROP [PSIG]	CAPACITY [LB/HR]	DESIGN PRESSURE [PSI]	FLUID SYSTEM	FLOW [GPM]	ENT TEMP [°F]	LVG TEMP [°F]	DESIGN PRESSURE [PSI]	NOTES
SHX	1&2	BY OWNER	BY OWNER	L2 S MECH ROOM	8,800,000	STEAM	110	9500	40	WATER	233	105	180	150	1

NOTES:

1. DUPLEX HEAT EXCHANGER SKID PROVIDED BY OWNER. CONTRACTOR TO PROVIDE 120V, SINGLE PHASE POWER TO CONTROL PANEL.

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

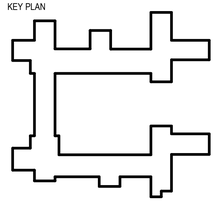
GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: 11/05/2021

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL SCHEDULES - SHEET 2

GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN: MJ DATE: 11/05/2021

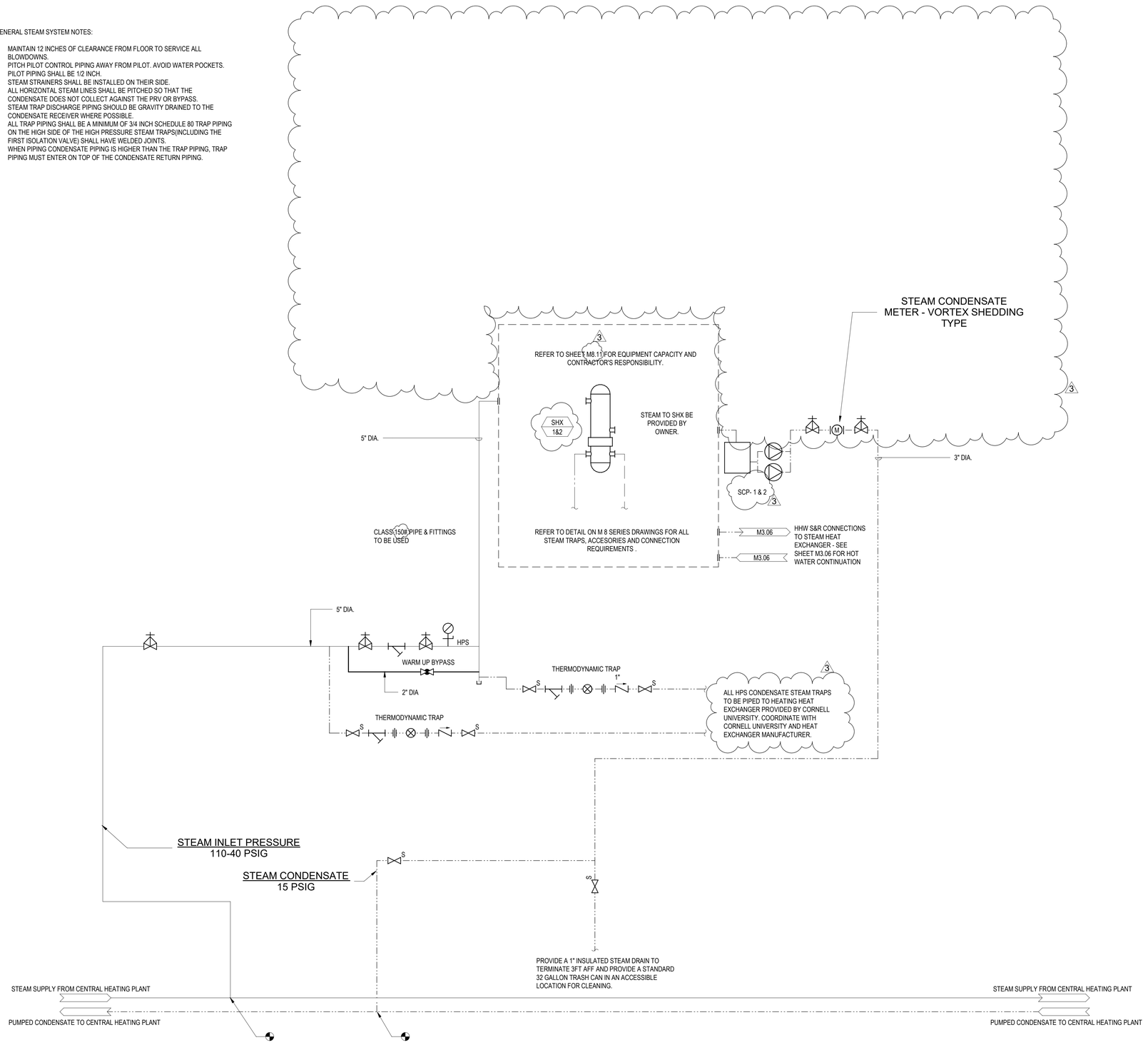
CHECKED: AJ SCALE: NTS

DRAWING NO.:

M0.04

GENERAL STEAM SYSTEM NOTES:

1. MAINTAIN 12 INCHES OF CLEARANCE FROM FLOOR TO SERVICE ALL BLOWDOWNS.
2. PITCH PILOT CONTROL PIPING AWAY FROM PILOT. AVOID WATER POCKETS.
3. PILOT PIPING SHALL BE 1/2 INCH.
4. STEAM STRAINERS SHALL BE INSTALLED ON THEIR SIDE.
5. ALL HORIZONTAL STEAM LINES SHALL BE PITCHED SO THAT THE CONDENSATE DOES NOT COLLECT AGAINST THE PRV OR BYPASS.
6. STEAM TRAP DISCHARGE PIPING SHOULD BE GRAVITY DRAINED TO THE CONDENSATE RECEIVER WHERE POSSIBLE.
7. ALL TRAP PIPING SHALL BE A MINIMUM OF 3/4 INCH SCHEDULE 80 TRAP PIPING ON THE HIGH SIDE OF THE HIGH PRESSURE STEAM TRAPS(INCLUDING THE FIRST ISOLATION VALVE) SHALL HAVE WELDED JOINTS.
8. WHEN PIPING CONDENSATE PIPING IS HIGHER THAN THE TRAP PIPING, TRAP PIPING MUST ENTER ON TOP OF THE CONDENSATE RETURN PIPING.



1 STEAM SINGLE LINE DIAGRAM
NTS

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

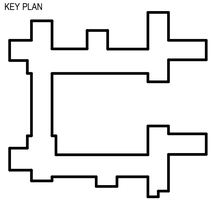
CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL STEAM SINGLE LINE DIAGRAM

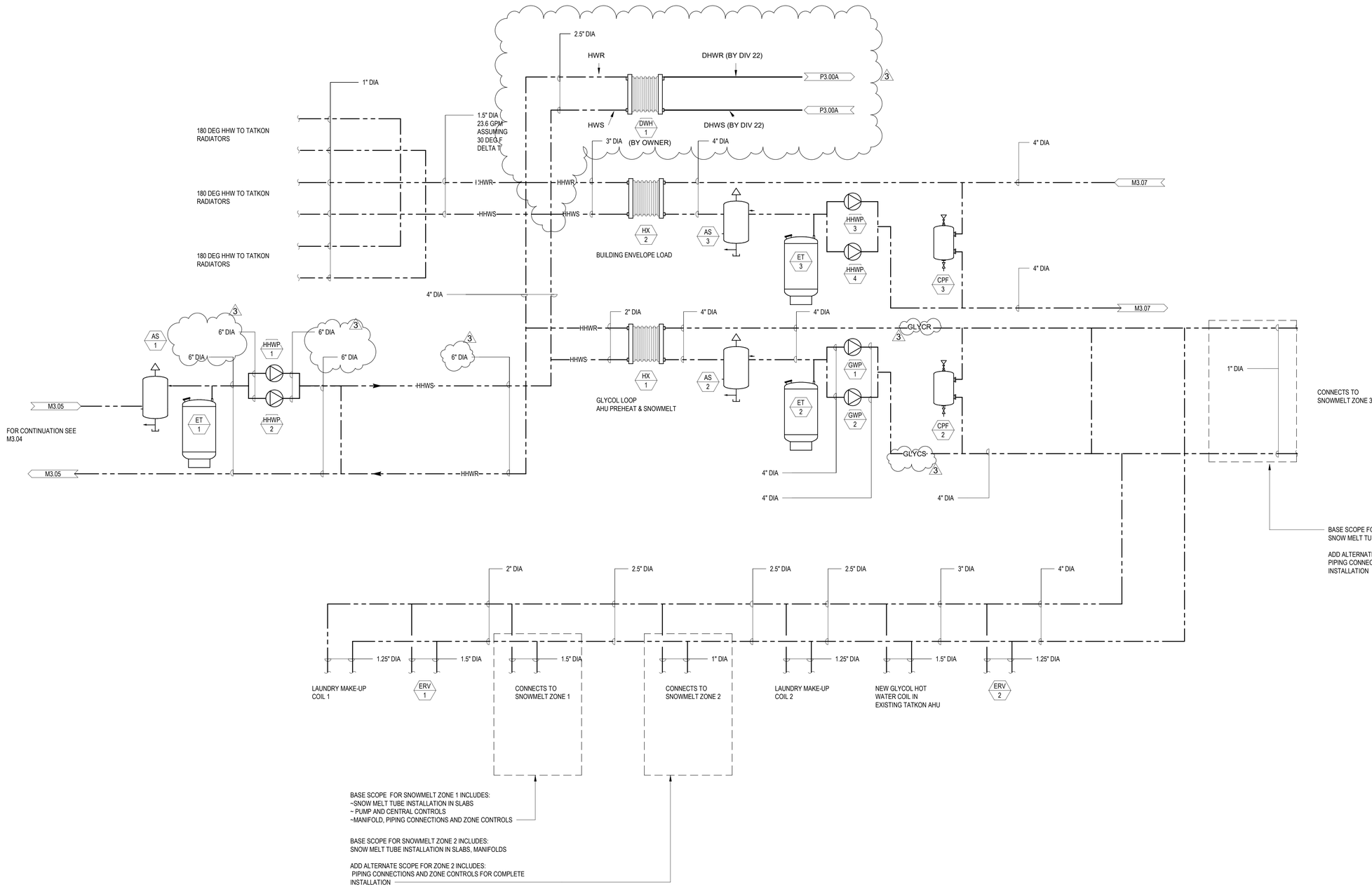
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: NTS

DRAWING NO.:

M3.05



BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

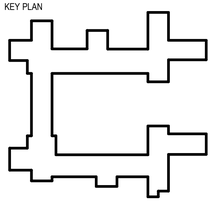
GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL HHW SINGLE LINE DIAGRAM - SHEET 1

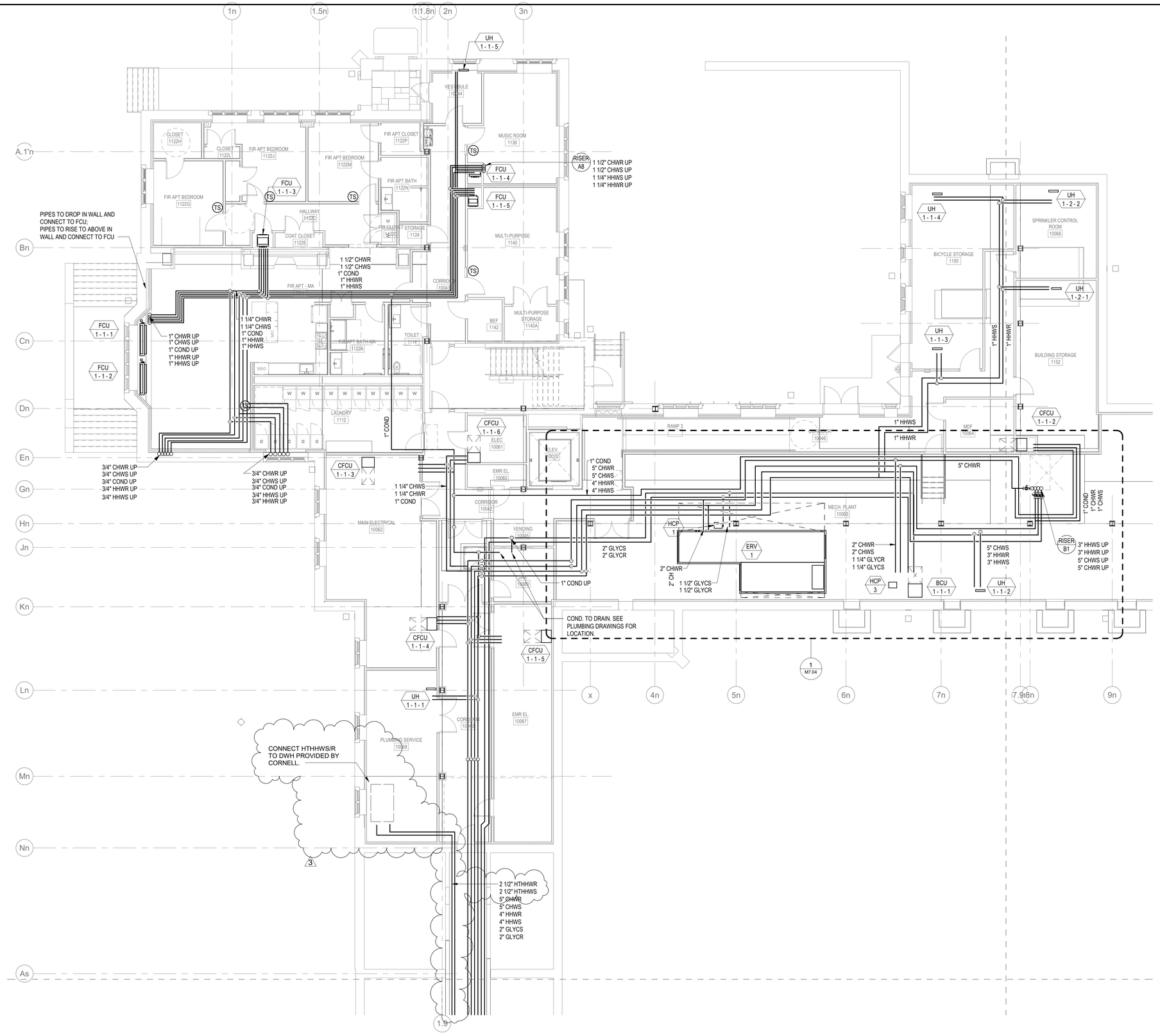
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: NTS

DRAWING NO.:

M3.06



8/5/2022 6:15:53 PM
C:\Users\michaelson.joseph\Documents\Revit Local Files\MECH_07400-Cornell-Balch_R21_Michaelson.Joseph.rvt

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

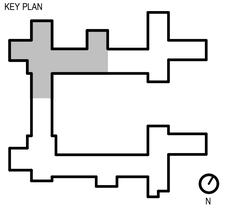
GOODY CLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022
2	Bulletin #2	05/23/2022

MECHANICAL PIPE FIRST FLOOR PLAN - A

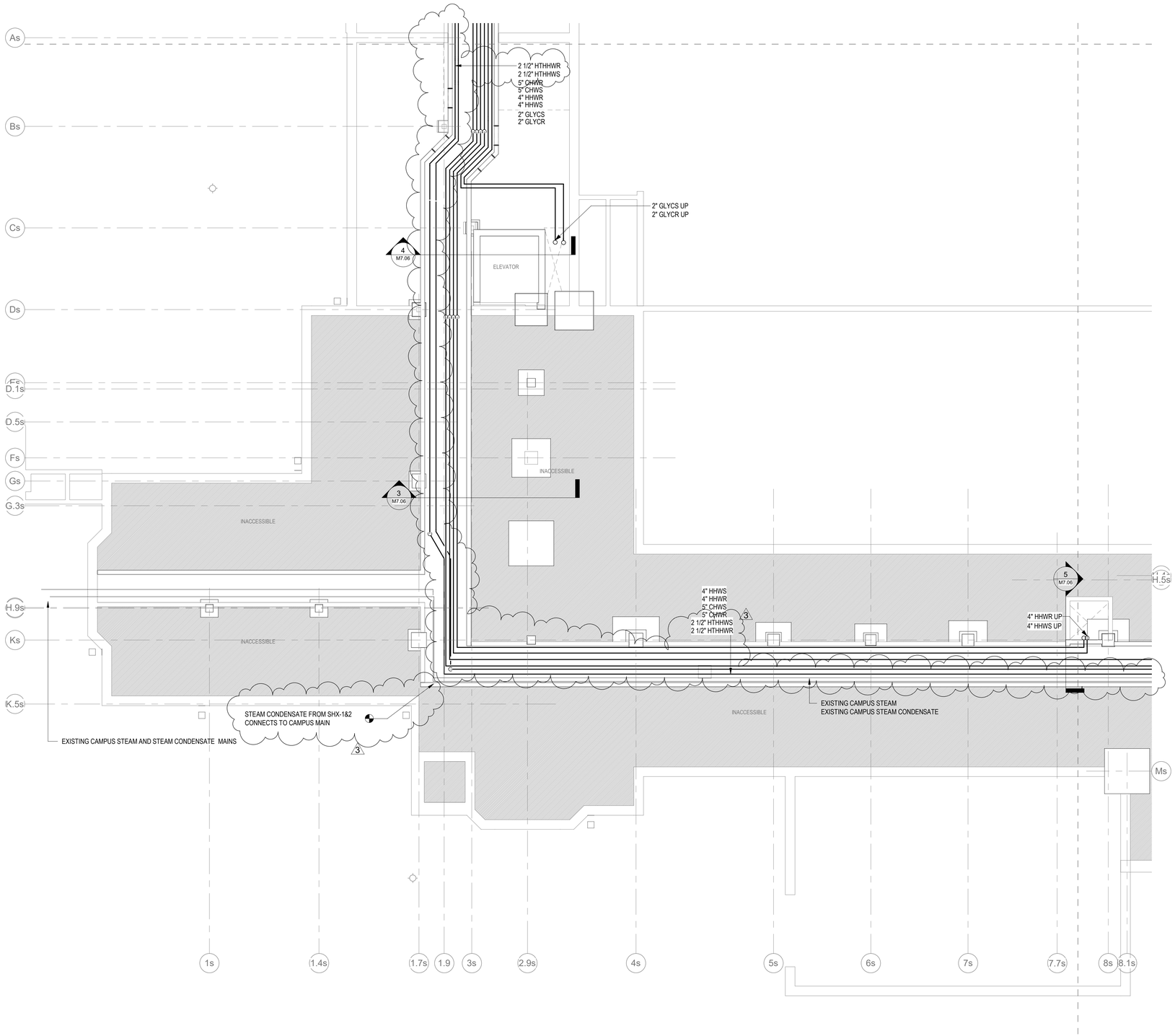
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: 1/8" = 1'-0"

DRAWING NO.:

M5.11A



8/5/2022 6:15:54 PM
C:\Users\michaelson.joseph\Documents\Revit Local Files\MECH_07400-Comell-Balch_R21_Michaelson.Joseph.rvt

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

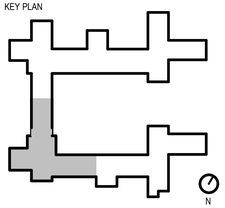
CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL PIPE FIRST FLOOR PLAN - C

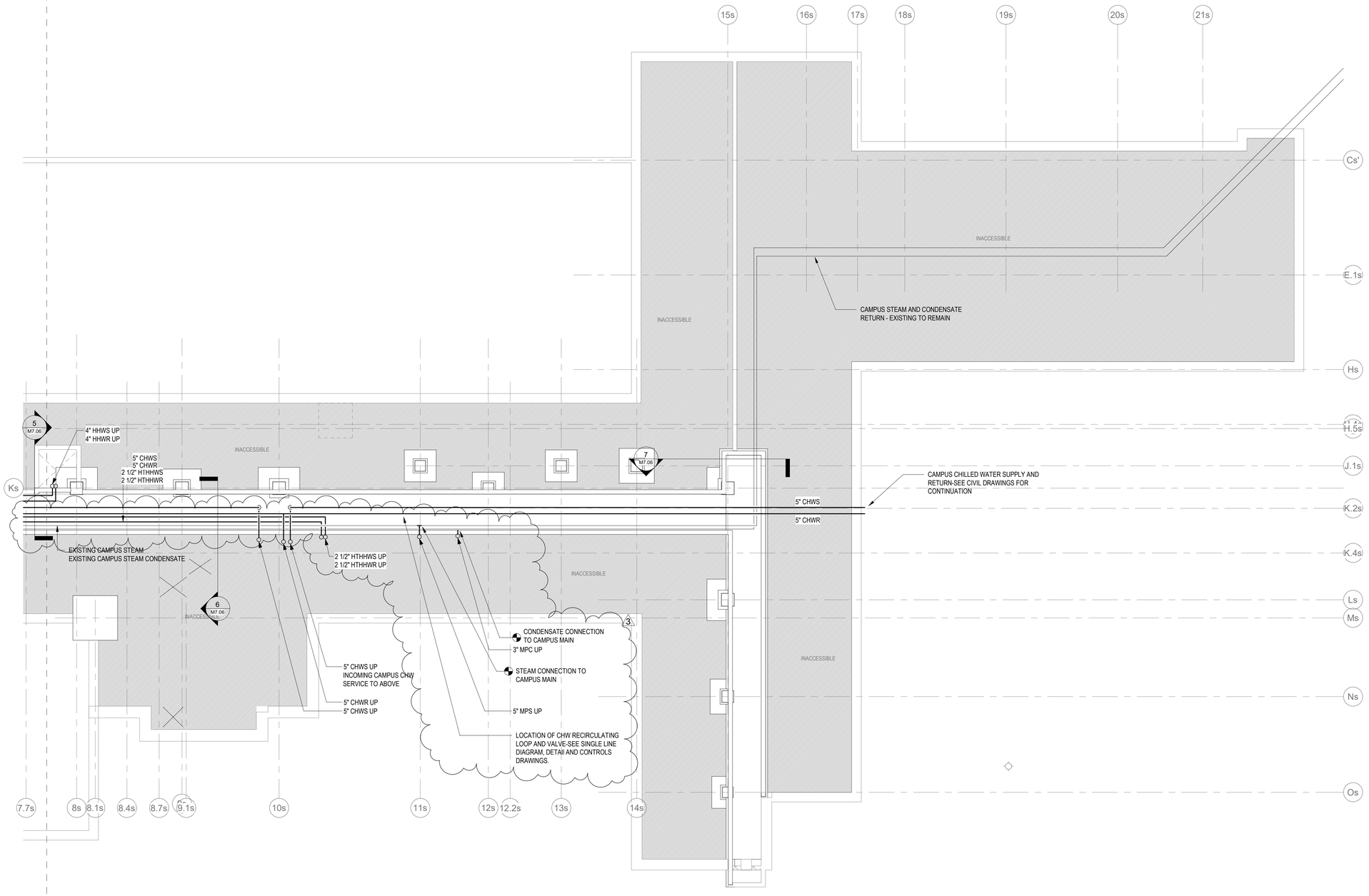
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: 1/8" = 1'-0"

DRAWING NO.:

M5.11C



BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

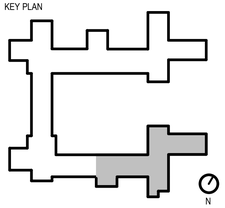
CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL PIPE FIRST FLOOR PLAN - D

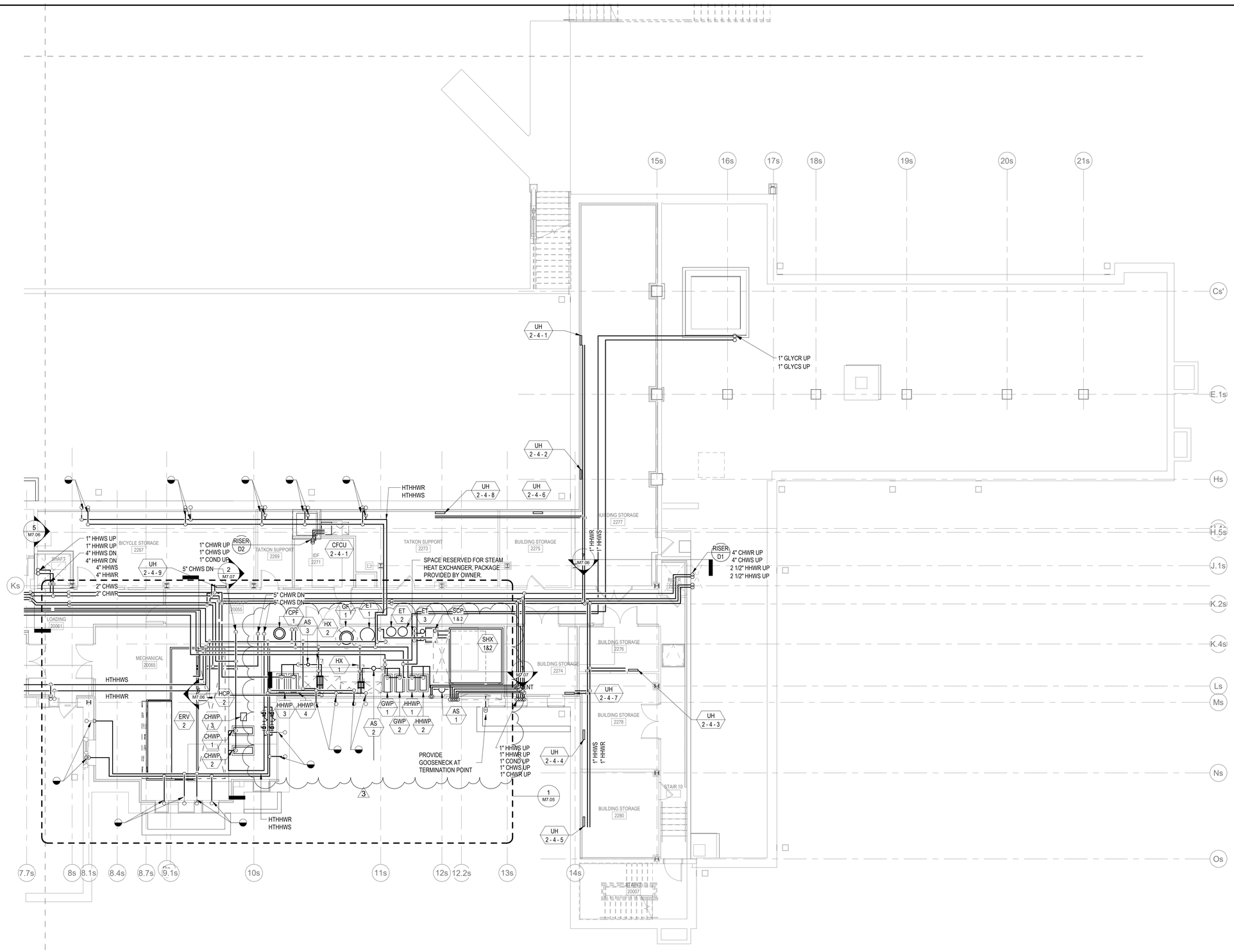
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: 1/8" = 1'-0"

DRAWING NO.:

M5.11D



BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL PIPE SECOND FLOOR PLAN - D

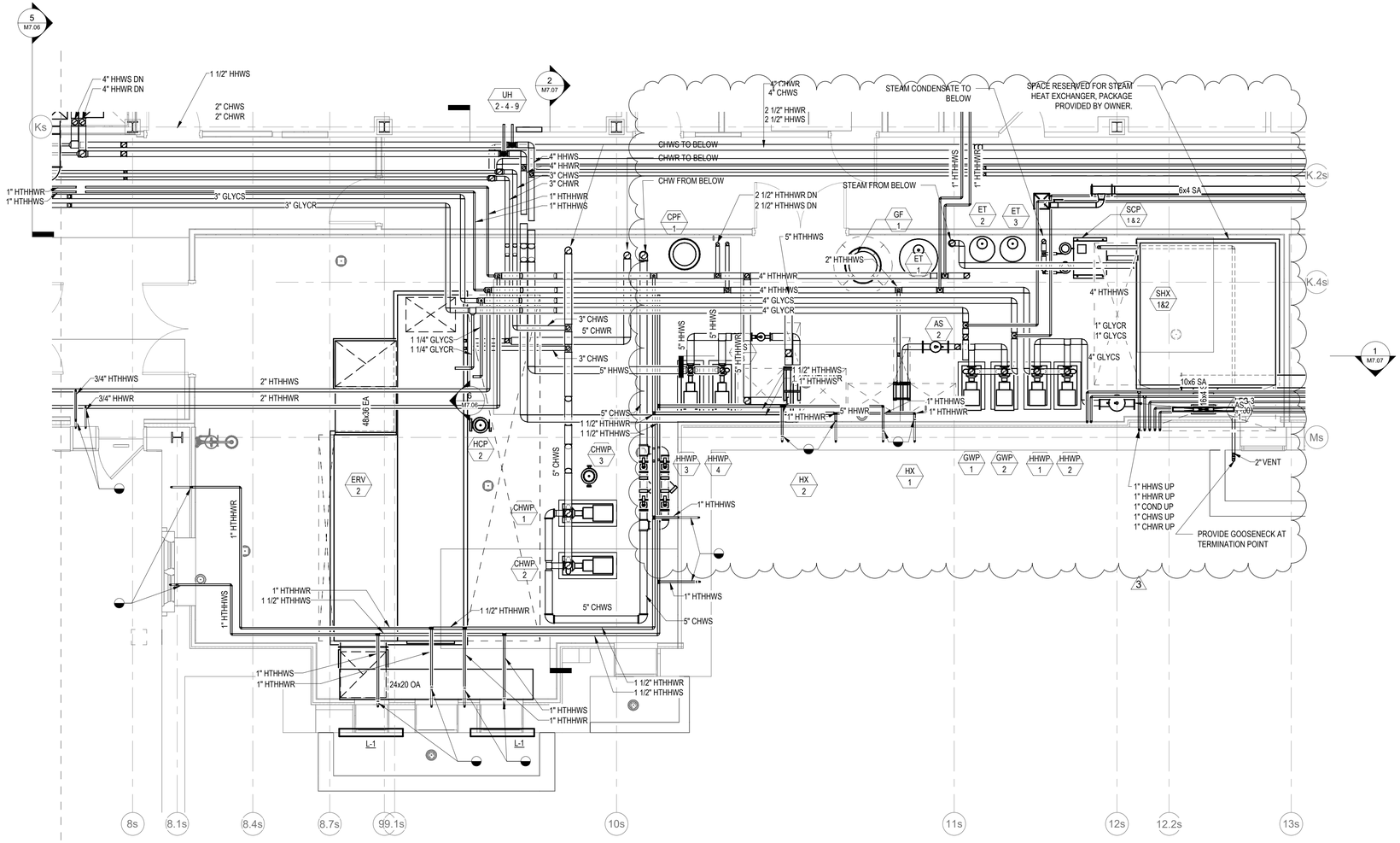
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: 1/8" = 1'-0"

DRAWING NO.:

M5.12D



1 2ND FLOOR SOUTH MECHANICAL ROOM - ENLARGED PLAN

1/4" = 1'-0"

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

N

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL ENLARGED PART PLANS - SHEET 5

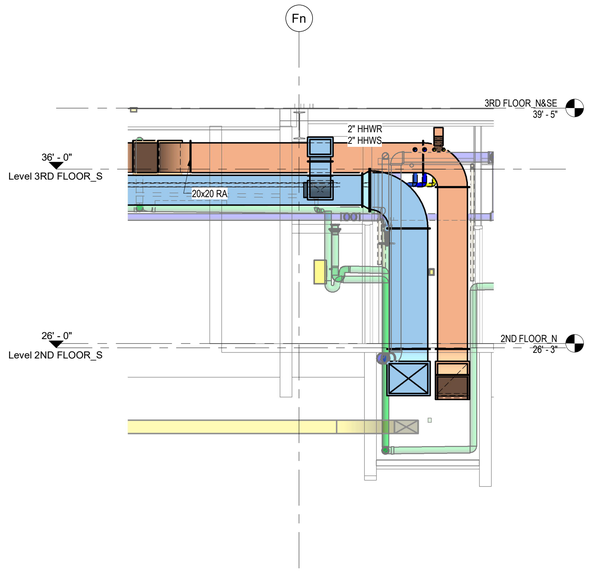
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

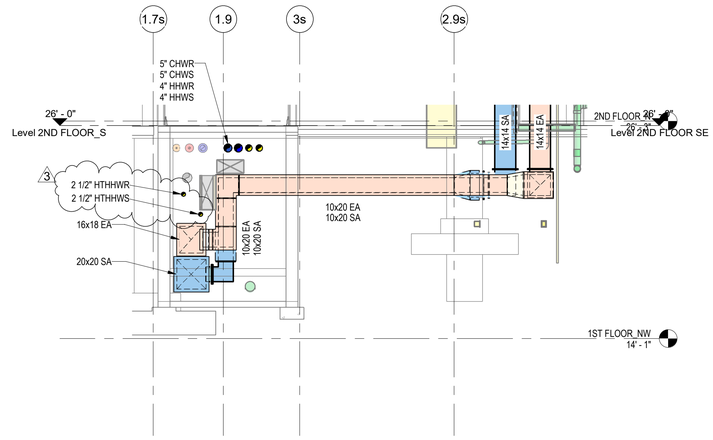
DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: AS INDICATED

DRAWING NO.:

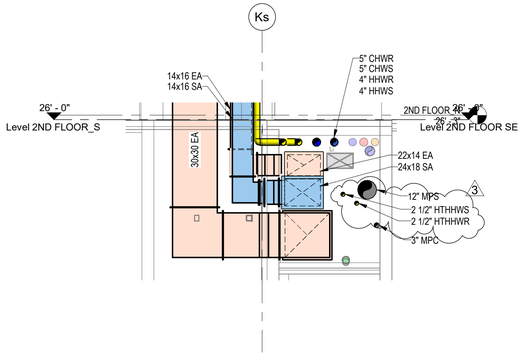
M7.05



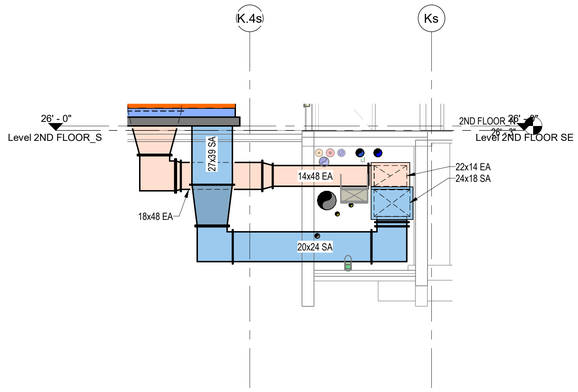
1 MECHANICAL TUNNEL SECTION - AREA B.1
1/4" = 1'-0"



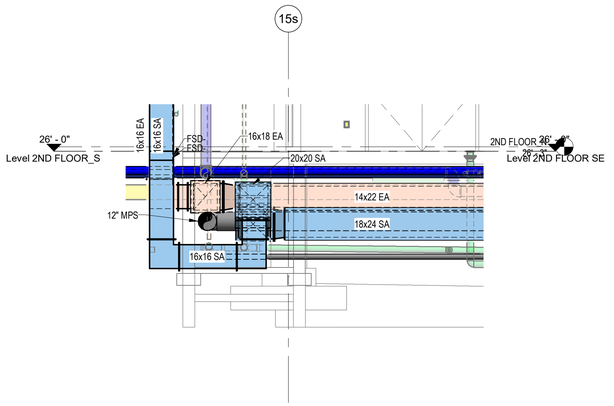
3 MECHANICAL TUNNEL SECTION - AREA C.2
1/4" = 1'-0"



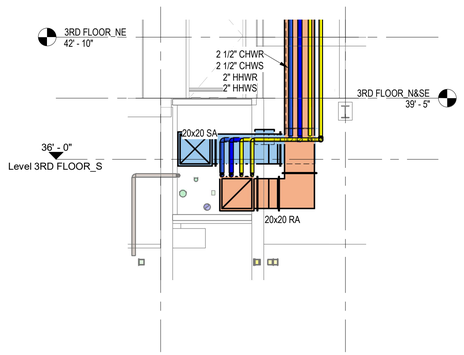
5 MECHANICAL TUNNEL SECTION - AREA D.1
1/4" = 1'-0"



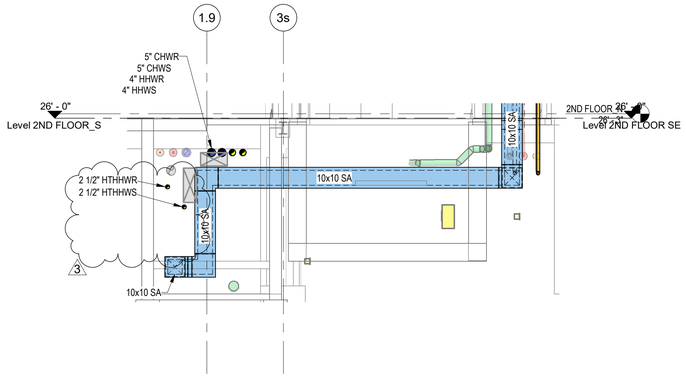
6 MECHANICAL TUNNEL SECTION - AREA D.2
1/4" = 1'-0"



7 MECHANICAL TUNNEL SECTION - AREA D.3
1/4" = 1'-0"



2 MECHANICAL TUNNEL SECTION - AREA B.2
1/4" = 1'-0"



4 MECHANICAL TUNNEL SECTION - AREA C.1
1/4" = 1'-0"

8/5/2022 6:16:24 PM
C:\Users\michaelson.joseph\Documents\Revit Local Files\MECH_07400-Comell-Balch_R21_Michaelson.Joseph.rvt

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

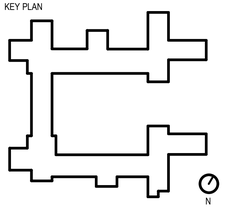
600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT
ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL SECTIONS - SHEET 1

GOODY CLANCY PROJECT NUMBER07400

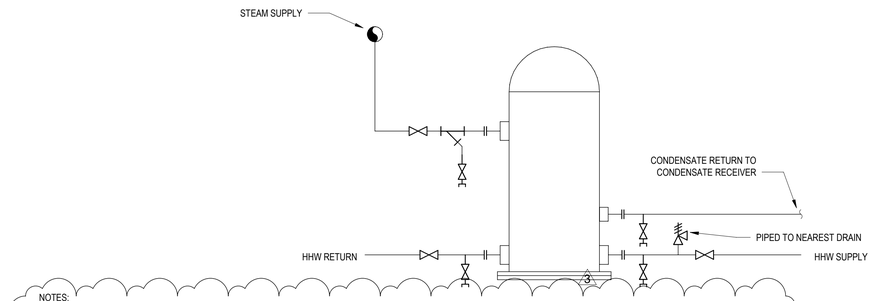
FILE NAME:

DRAWN: Author DATE: 11/05/2021

CHECKED: Checker SCALE: AS INDICATED

DRAWING NO.:

M7.06

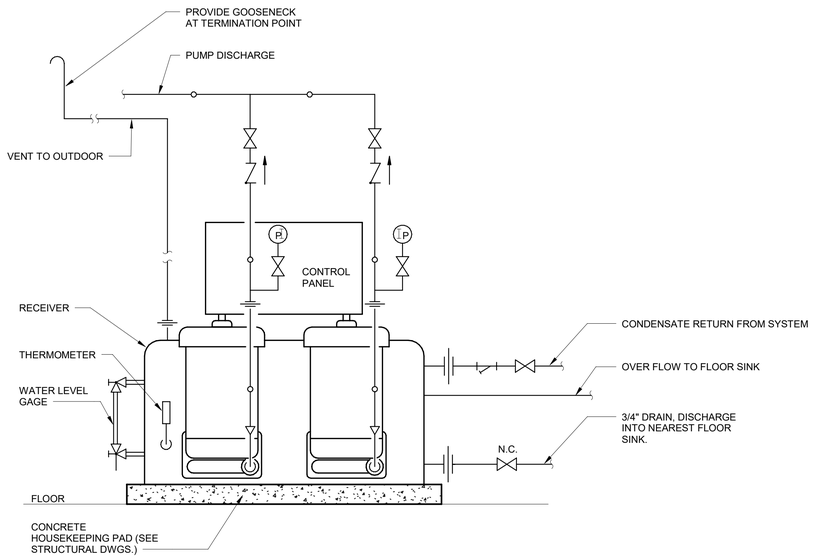


NOTES:
1. COMPLETE HEAT EXCHANGER PACKAGED SKID PROVIDED BY OWNER. CONTRACTOR TO PARTICIPATE IN COORDINATION OF FINAL LOCATION AND CONNECT SYSTEMS AT FOUR FLANGED CONNECTIONS AS SHOWN.
2. OWNER TO PROVIDE AND INSTALL VERTICAL FLOODED STEAM TO HOT WATER HEAT EXCHANGER, SHX-1 WITH CAPACITY OF 8,800,000 BTU/HR, STEAM CAPACITY OF 9,500 LB/HR AND DESIGN PRESSURE OF 40 PSIG. THE SECONDARY SIDE OF THE HEAT EXCHANGER SHALL HAVE OPERATE WITH WATER WITH TOTAL OF 233 GPM, ENT. WATER TEMP = 105 °F & LVG. WATER TEMP. = 180 °F WITH MAXIMUM PRESSURE DROP EQUAL TO 9.9 FT.WC. AND DESIGN PRESSURE =150 PSI

3

1 STEAM TO LIQUID HEAT EXCHANGER PIPING DETAIL
NTS

3



3 STEAM PIPE CONNECTION - CONDENSATE PUMP
NTS

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

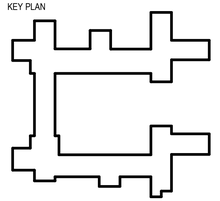
CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL DETAILS - SHEET 11

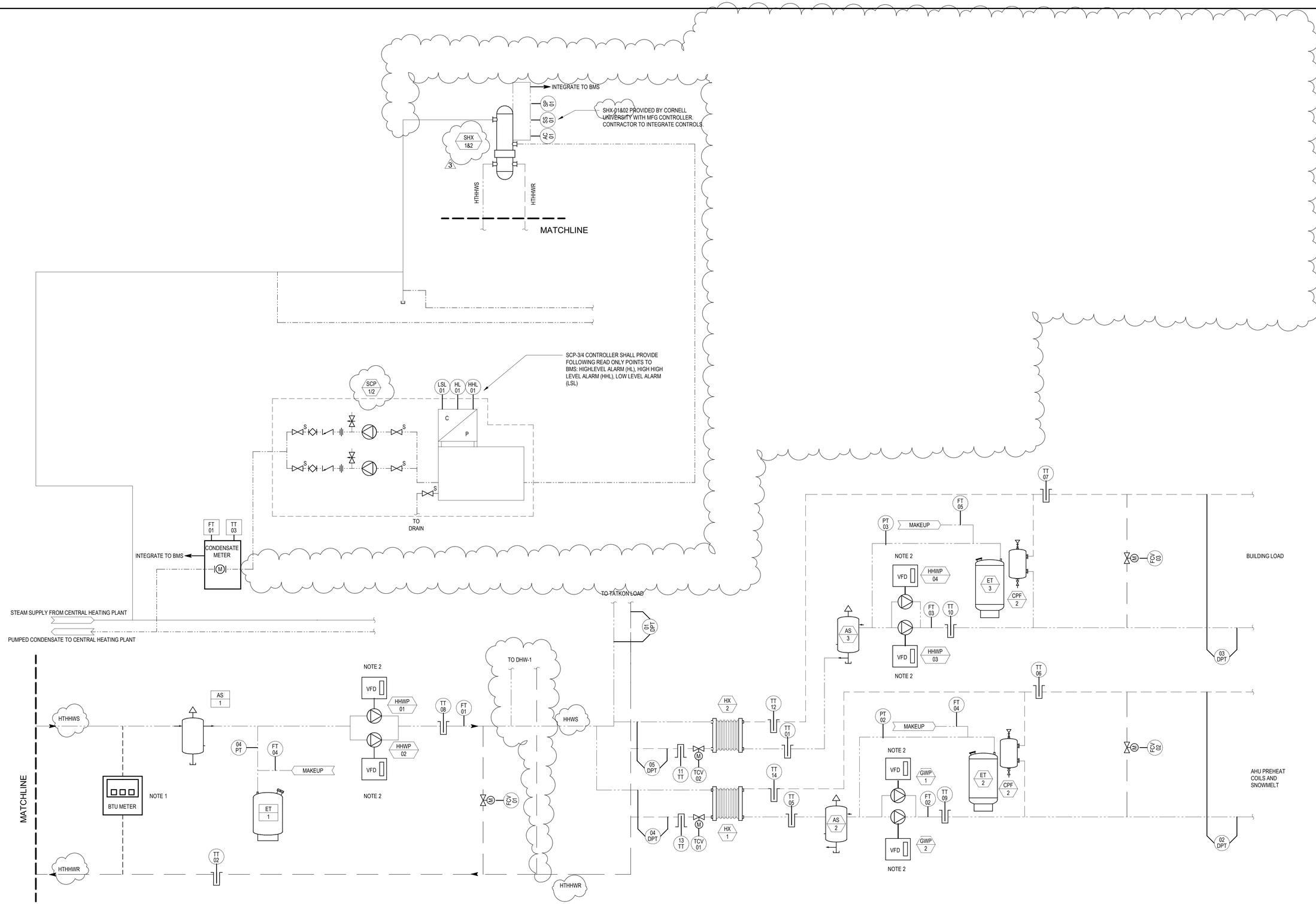
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: NTS

DRAWING NO.:

M8.11



NOTES:
1. REFER TO BTU METER DETAIL FOR POINTS AND INTEGRATION REQUIREMENTS.
2. REFER TO VFD DETAIL FOR POINTS AND INTEGRATION REQUIREMENTS
3. REFER TO NEXT PAGE FOR POINTS LIST AND SEQUENCE.

8/5/2022 6:16:05 PM
C:\Users\michaelson_joseph\Documents\Revit Local Files\MECH_07400-Cornell-Balch_R21_Michaelson_Joseph.rvt

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT
ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL CONTROLS - STEAM TO HHW - SHEET 1

GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: NTS

DRAWING NO.:

M9.05

PRIMARY LOOP SEQUENCE OF OPERATIONS

A. DESIGN:
1.HIGH PRESSURE STEAM IS PROVIDED FROM A CAMPUS LOOP TO TWO STEAM TO HOT WATER VERTICAL FLOODED HEAT EXCHANGERS. ONE HX IS SIZED FOR 100% OF THE BUILDING HEATING HHW LOAD AND ONE HX IS SIZED FOR 100% OF THE DHW LOAD. EACH HHW PUMP IS SIZED FOR 100% OF THE BUILDING LOAD FOR FULL DUTY STANDBY OPERATION. THE HHW DISTRIBUTION SYSTEM IS PRIMARY VARIABLE AND FEEDS INTO TWO OTHER HEAT EXCHANGERS FOR DIFFERENT BUILDING LOADS.

B. GENERAL:
1. PRIMARY HEATING HOT WATER DUTY PUMP VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
2. PRIMARY HEATING HOT WATER STANDBY PUMP VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
3. HEATING HOT WATER LOOP MINIMUM FLOW VALVE, NORMALLY OPEN.
4. HEAT EXCHANGER TEMPERATURE CONTROL VALVE (TCV-01), FAIL LAST POSITION
5. HEAT EXCHANGER TEMPERATURE CONTROL VALVE (TCV-02), FAIL LAST POSITION

C. ALARMS:
1. IF THE PRIMARY DUTY HEATING HOT WATER PUMP FAILS, AN ALARM SHALL BE SENT TO THE BAS, AND THE HX SYSTEM SHALL BE SHUT DOWN. THE STANDBY PUMP SHALL REPLACE THE FAILED PUMP IN THE ROTATION, AND START IMMEDIATELY. AFTER 5 MINUTES (ADJ.) AND CONFIRMATION OF PRIMARY LOOP FLOW AT SETPOINT, NORMAL SYSTEM START SHALL COMMENCE. THE FAILED PUMP SHALL REMAIN OUT OF THE ROTATION UNTIL MANUALLY RESET.
2. IF THE GENERAL ALARM FROM THE PACKAGED HX SYSTEM IS DETECTED, AN ALARM SHALL BE INDICATED AT THE BAS.
3. IF THE HHWS TEMPERATURE DROPS 10°F(ADJ.) BELOW SETPOINT AS MEASURED BY THE PRIMARY LOOP TEMPERATURE SENSOR FOR 10 MINUTES (ADJ.), AN ALARM SHALL BE INDICATED AT THE BAS.
4. STEAM TEMPERATURES SHALL BE MONITORED AT THE BAS. IF THE STEAM TEMP ENCOUNTERS A LOW TEMP OR HIGH TEMP CONDITION FOR 5 MINUTES (ADJ.), AN ALARM SHALL BE INDICATED AT THE BAS.
5. STEAM PRESSURES SHALL BE MONITORED AT THE BAS. IF THE STEAM PRESSURE ENCOUNTERS A LOW TEMP OR HIGH PRESSURE CONDITION FOR 5 MINUTES (ADJ.), AN ALARM SHALL BE INDICATED AT THE BAS.

D. SETPOINTS:
1. HEATING HOT WATER SETPOINT
a. THE HEATING HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL RESET LINEARLY BETWEEN 180°F (ADJ.) AND 150°F(ADJ.) AS THE OUTDOOR AIR TEMPERATURE RISES FROM 25 °F(ADJ.) TO 55° F (ADJ.).
2. DIFFERENTIAL PRESSURE SETPOINT
a. THE DIFFERENTIAL PRESSURE SETPOINT SHALL BE A CONSTANT 14 PSI (ADJ). THE SETPOINT SHALL BE ADJUSTED BY THE BALANCING CONTRACTOR TO THE MINIMUM POSSIBLE DIFFERENTIAL PRESSURE SUFFICIENT TO PROVIDE FULL FLOW TO THE COILS AND HEAT EXCHANGERS . EACH DIFFERENTIAL PRESSURE SENSOR INSTALLED SHALL HAVE ITS OWN DPT SETPOINT DETERMINED DURING BALANCING.
3. MINIMUM PRIMARY LOOP FLOW SETPOINT
a. THE PRIMARY LOOP FLOW SETPOINT SHALL BE EQUAL TO THE MINIMUM ALLOWABLE FLOW THROUGH THE HEAT EXCHANGER (HX-1 AND HX-2) OR THE MINIMUM ALLOWABLE PUMP FLOW, WHICHEVER IS GREATER. FINAL SETPOINT SHALL BE COORDINATED WITH THE APPROVED SUBMITTALS.
4. DIFFERENTIAL PRESSURE RESET.
a. THE PRIMARY HHW LOOP DIFFERENTIAL SETPOINT SHALL RESET IN A TRIM AND RESPOND FASHION. A REQUEST SHALL BE GENERATED BY EACH ZONE SERVED WITH A COIL VALVE POSITION GREATER THAN 90% (ADJ.). AFTER THE SYSTEM HAS PROVEN ON FOR 5 MINUTES, THE SYSTEM SHALL BEGIN TO TRIM THE DIFFERNTIAL PRESSURE SETPOINT BY 1 PSI ((ADJ.) EVERY 5 MINUTES. THE SYSTEM SHALL RESPOND (INCREASE) THE SETPOINT BY 0.5 PSI (ADJ.) FOR EACH REQUEST IN EXCESS OF 3, WITH A MAX. RESPONSE OF 1 PSI (ADJ.)

E. PACKAGED HTHHW TO DHW HEAT EXCHANGER
1. A MANUFACTURER'S PACAKAGED SYSTEM SHALL MAINTAIN THE DHW AT SETPOINT. THE HX CONTROLLER SHALL BE INTEGRATED TO THE BAS VIA BACNET IP.

F. PACKAGED STEAM TO HHW HEAT EXCHANGER
1. A MANUFACTURER'S PACAKAGED SYSTEM SHALL MAINTAIN THE HHW AT SETPOINT. THE HX CONTROLLER SHALL BE INTEGRATED TO THE BAS VIA BACNET IP.

G. PACKAGED CONDENSATE PUMPING STATION:
1. A MANUFACTURER'S PACKAGED SYSTEM SHALL CONTROL THE STEAM CONDENSATE PUMPS. THE SYSTEM SHALL BE INTEGRATED WITH THE BAS VIA BACNET IP. ALARM CONTACTS SHALL BE HARDWIRED TO BAS.

H. SYSTEM OFF:
1. IF THE ASSOCIATED HEATING CONTROL VALVES ARE ALL CLOSED AND THE BUILDING LOOP AND AHU COIL LOOP PUMPS HAVE DE-ENERGIZED , AFTER A 5 MINUTE (ADJ.) DELAY, THE PUMPS SHALL RAMP DOWN TO 0% SPEED, AND ALL DEVICES AND EQUIPMENT SHALL BE INDEXED TO THEIR NORMAL POSITION.
2. THE MANUFACTURER'S CONTROLLER SHALL DE-ENERGIZE THE HX.

I. SYSTEM RUN:
1. ON A CALL TO RUN FROM THE ASSOCIATED BUILDING AND AHU COIL LOOP, THE MANUFACTURERS CONTROLLER SHALL ENERGIZE THE HX.
2. ONCE THE HX HAS PROVEN ON VIA THE MANUFACTURERS CONTROLLER, THE PRIMARY DUTY HEATING HOT WATER PUMP VFD SHALL SLOWLY RAMP UP SPEED (2 MIN (ADJ.)) TO 40%(ADJ.)THEN MODULATE SPEED IN ORDER TO MAINTAIN THE PRIMARY HHW LOOP AT THE DIFFERENTIAL SETPOINT.
3. THE PRIMARY LOOP MINIMUM FLOW BYPASS VALVES SHALL MODULATE TO MAINTAIN THE PRIMARY FLOWS AT THE MINIMUM FLOW SETPOINT, AS MEASURED BY THEIR RESPECTIVE FLOW METERS.

J. PUMP ROTATION:
1. EVERY OTHER SUNDAY AT MIDNIGHT (ADJ.) THE DUTY PUMP SHALL ROTATE TO WHICHEVER PUMP HAS THE LOWEST TOTAL RUNTIME. DURING THE SWITCHOVER THE STANDBY PUMP SHALL SLOWLY RAMP UP SPEED TO (40%) (ADJ.). ONCE THE STANDBY PUMP REACHES 40% IT SHALL ROTATE TO DUTY AND MAINTAIN THE FLOW/PRESSURE SETPOINT. ONCE THE SWITCH IS MADE THE FORMER STANDBY PUMP SHALL SLOWLY (5 MIN (ADJ.)) RAMP DOWN TO 0% SPEED AND DE-ENERGIZE.

K. PUMP FAILURE
1. IF THE DUTY PUMP FAILS, THE SYSTEM SHALL INDICATE AN ALARM AT THE BAS . THE STANDBY PUMP SHALL IMMEDIATELY START AND RAMP UP SPEED TO REPLACE THE DUTY PUMP IN ROTATION. THE FAILED PUMP SHALL REMAIN OUT OF THE ROTATION UNTIL MANUALLY RESET AT THE BAS.

AHU COIL LOOP SEQUENCE OF OPERATION

A. GENERAL:
1. AHU COIL PRIMARY DUTY PUMP, VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
2. AHU COIL STANDBY PUMP, VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
3. AHU COIL LOOP MINIMUM FLOW VALVE, FAIL OPEN.
4. AHU COIL LOOP TEMPERATURE CONTROL VALVE, MODULATING TYPE, FAIL IN PLACE.

B. DESIGN: A SECONDARY GLYCOL LOOP OFF OF THE MAIN HHW LOOP IS SIZED TO PROVIDE THE FULL HEATING LOAD OF THE AHU COILS WITH TWO PUMPS IN A DUTY STANDBY OPERATION. EACH PUMP IS SIZED FOR THE FULL AHU COIL LOAD.

C. SETPOINTS:
1. AHU COIL LOOP DIFFERENTIAL PRESSURE SETPOINT
a.THE DIFFERENTIAL PRESSURE SETPOINT SHALL BE A CONSTANT 14 PSI (ADJ). THE SETPOINT SHALL BE ADJUSTED BY THE BALANCING CONTRACTOR TO THE MINIMUM POSSIBLE DIFFERENTIAL PRESSURE SUFFICIENT TO PROVIDE FULL FLOW TO THE COILS . EACH DIFFERENTIAL PRESSURE SENSOR INSTALLED SHALL HAVE ITS OWN DPT SETPOINT DETERMINED DURING BALANCING.
2. AHU COIL LOOP MINIMUM FLOW SETPOINT
a. THE MINIMUM FLOW SETPOINT SHALL BE SET TO THE MINIMUM PUMP FLOW + 10 GPM (ADJ.). MINIIMUM FLOW SETPOINT TO BE COORDINATED WITH THE APPROVED SUBMITTAL.
3. HEATING HOT WATER SETPOINT
a. THE HEATING HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL RESET LINEARLY BETWEEN 130°F (ADJ.) AND 100°F(ADJ.) AS THE OUTDOOR AIR TEMPERATURE RISES FROM 25 °F(ADJ.) TO 55° F (ADJ.).

D. SYSTEM OFF:
1. IF THE ASSOCIATED HEATING CONTROL VALVES ARE ALL CLOSED OR THE MAIN SYSTEM IS OFF, AFTER 1MIN (ADJ.), THE PUMPS SHALL RAMP DOWN TO 0% SPEED, ALL DEVICES AND EQUIPMENT SHALL THEN BE INDEXED TO THEIR NORMAL POSITIONS.

E. HEATING MODE
1. THE AHU COIL LOOP SHALL START ON A CALL FOR HEATING FROM ANY OF THE HEATING VALVES SERVED.
2. AFTER 1 MIN DELAY(ADJ.), THE PRIMARY DUTY PUMP VFD SHALL SLOWLY RAMP UP SPEED (2 MIN (ADJ.)) TO 40%(ADJ.) AND THE HEAT EXCHANGER VALVE (TCV-01) SHALL MODULATE OPEN. THE PUMP SHALL THEN MODULATE SPEED IN ORDER TO MAINTAIN THE PRIMARY HHW LOOP AT THE DIFFERENTIAL SETPOINT.
3. THE PRIMARY LOOP MINIMUM FLOW BYPASS VALVES SHALL MODULATE TO MAINTAIN THE PRIMARY FLOWS AT THE MINIMUM FLOW SETPOINT, AS MEASURED BY THEIR RESPECTIVE FLOW METERS.

F. DIFFERENTIAL PRESSURE RESET.
1. THE PRIMARY HHW LOOP DIFFERENTIAL SETPOINT SHALL RESET IN A TRIM AND RESPOND FASHION. A REQUEST SHALL BE GENERATED BY EACH ZONE SERVED WITH A COIL VALVE POSITION GREATER THAN 90% (ADJ.). AFTER THE SYSTEM HAS PROVEN ON FOR 5 MINUTES, THE SYSTEM SHALL BEGIN TO TRIM THE DIFFERNTIAL PRESSURE SETPOINT BY 1 PSI ((ADJ.) EVERY 5 MINUTES. THE SYSTEM SHALL RESPOND (INCREASE) THE SETPOINT BY 0.5 PSI (ADJ.) FOR EACH REQUEST IN EXCESS OF 3, WITH A MAX. RESPONSE OF 1 PSI (ADJ.)

G. PUMP ROTATION:
1. EVERY OTHER SUNDAY AT MIDNIGHT (ADJ.) THE DUTY PUMP SHALL ROTATE TO WHICHEVER PUMP HAS THE LOWEST TOTAL RUNTIME. DURING THE SWITCHOVER THE STANDBY PUMP SHALL SLOWLY RAMP UP SPEED TO (40%) (ADJ.). ONCE THE STANDBY PUMP REACHES 40% IT SHALL ROTATE TO DUTY AND MAINTAIN THE FLOW/PRESSURE SETPOINT. ONCE THE SWITCH IS MADE THE FORMER STANDBY PUMP SHALL SLOWLY (5 MIN (ADJ.)) RAMP DOWN TO 0% SPEED AND DE-ENERGIZE.

H. PUMP FAILURE
1. IF THE DUTY PUMP FAILS, THE SYSTEM SHALL INDICATE AN ALARM AT THE BAS . THE STANDBY PUMP SHALL IMMEDIATELY START AND RAMP UP SPEED TO REPLACE THE DUTY PUMP IN ROTATION. THE FAILED PUMP SHALL REMAIN OUT OF THE ROTATION UNTIL MANUALLY RESET AT THE BAS.

BUILDING LOOP SEQUENCE OF OPERATION

A. GENERAL:
1. PRIMARY DUTY PUMP, VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
2. STANDBY PUMP, VFD, MODULATING SPEED, 25% MINIMUM(ADJ.).
3. MINIMUM FLOW VALVE, FAIL OPEN.
4. TEMPERATURE CONTROL VALVE, MODULATING TYPE, FAIL IN PLACE.

B. DESIGN: A SECONDARY LOOP OFF OF THE MAIN HHW LOOP IS SIZED TO PROVIDE THE FULL HEATING LOAD OF THE BUILDING WITH TWO PUMPS IN A DUTY STANDBY OPERATION. EACH PUMP IS SIZED FOR THE FULL BUILDING LOAD.

C. SETPOINTS:
1. BUILDING LOOP DIFFERENTIAL PRESSURE SETPOINT
a.THE DIFFERENTIAL PRESSURE SETPOINT SHALL BE A CONSTANT 14 PSI (ADJ). THE SETPOINT SHALL BE ADJUSTED BY THE BALANCING CONTRACTOR TO THE MINIMUM POSSIBLE DIFFERENTIAL PRESSURE SUFFICIENT TO PROVIDE FULL FLOW TO THE COILS . EACH DIFFERENTIAL PRESSURE SENSOR INSTALLED SHALL HAVE ITS OWN DPT SETPOINT DETERMINED DURING BALANCING.
2. BUILDING LOOP MINIMUM FLOW SETPOINT
a. THE MINIMUM FLOW SETPOINT SHALL BE SET TO THE MINIMUM PUMP FLOW + 10 GPM (ADJ.). MINIIMUM FLOW SETPOINT TO BE COORDINATED WITH THE APPROVED SUBMITTAL.
3. HEATING HOT WATER SETPOINT
a. THE HEATING HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL RESET LINEARLY BETWEEN 130°F (ADJ.) AND 100°F(ADJ.) AS THE OUTDOOR AIR TEMPERATURE RISES FROM 25 °F(ADJ.) TO 55° F (ADJ.).

D. SYSTEM OFF:
1. IF THE ASSOCIATED HEATING CONTROL VALVES ARE ALL CLOSED OR THE MAIN HEATING SYSTEM IS OFF, AFTER 1MIN (ADJ.), THE PUMPS SHALL RAMP DOWN TO 0% SPEED, ALL DEVICES AND EQUIPMENT SHALL THEN BE INDEXED TO THEIR NORMAL POSITIONS.

E. HEATING MODE
1. THE AHU COIL LOOP SHALL START ON A CALL FOR HEATING FROM ANY OF THE HEATING VALVES SERVED.
2. AFTER 1 MIN DELAY(ADJ.), THE PRIMARY DUTY PUMP VFD SHALL SLOWLY RAMP UP SPEED (2 MIN (ADJ.)) TO 40%(ADJ.) AND THE HEAT EXCHANGER VALVE (TCV-01) SHALL MODULATE OPEN. THE PUMP SHALL THEN MODULATE SPEED IN ORDER TO MAINTAIN THE PRIMARY HHW LOOP AT THE DIFFERENTIAL SETPOINT.
3. THE PRIMARY LOOP MINIMUM FLOW BYPASS VALVES SHALL MODULATE TO MAINTAIN THE PRIMARY FLOWS AT THE MINIMUM FLOW SETPOINT, AS MEASURED BY THEIR RESPECTIVE FLOW METERS

F. DIFFERENTIAL PRESSURE RESET.
1. THE PRIMARY HHW LOOP DIFFERENTIAL SETPOINT SHALL RESET IN A TRIM AND RESPOND FASHION. A REQUEST SHALL BE GENERATED BY EACH ZONE SERVED WITH A COIL VALVE POSITION GREATER THAN 90% (ADJ.). AFTER THE SYSTEM HAS PROVEN ON FOR 5 MINUTES, THE SYSTEM SHALL BEGIN TO TRIM THE DIFFERNTIAL PRESSURE SETPOINT BY 1 PSI ((ADJ.) EVERY 5 MINUTES. THE SYSTEM SHALL RESPOND (INCREASE) THE SETPOINT BY 0.5 PSI (ADJ.) FOR EACH REQUEST IN EXCESS OF 3, WITH A MAX. RESPONSE OF 1 PSI (ADJ.).

G. PUMP ROTATION:
1. EVERY OTHER MONDAY AT 6:00 AM (ADJ.) THE DUTY PUMP SHALL ROTATE TO WHICHEVER PUMP HAS THE LOWEST TOTAL RUNTIME. DURING THE SWITCHOVER THE STANDBY PUMP SHALL SLOWLY RAMP UP SPEED TO (40%) (ADJ.). ONCE THE STANDBY PUMP REACHES 40% IT SHALL ROTATE TO DUTY AND MAINTAIN THE FLOW/PRESSURE SETPOINT. ONCE THE SWITCH IS MADE THE FORMER STANDBY PUMP SHALL SLOWLY (5 MIN (ADJ.)) RAMP DOWN TO 0% SPEED AND DE-ENERGIZE.

H. PUMP FAILURE
1. IF THE DUTY PUMP FAILS, THE SYSTEM SHALL INDICATE AN ALARM AT THE BAS . THE STANDBY PUMP SHALL IMMEDIATELY START AND RAMP UP SPEED TO REPLACE THE DUTY PUMP IN ROTATION. THE FAILED PUMP SHALL REMAIN OUT OF THE ROTATION UNTIL MANUALLY RESET AT THE BAS.

POINTS LIST STEAM

POINT TYPE	ID	TAG	INSTRUMENT TYPE	NOTES	ALARM			TREND	GRAPHIC
					BACS	EMCS	DESCRIPTION		
AI	DPT	01	DIFFERENTIAL PRESSURE TRANSMITTER	TATKON LOOP DP	Yes	Yes	10% DEVIATION	Yes	Yes
AI	DPT	02	DIFFERENTIAL PRESSURE TRANSMITTER	AHU COILS DP	Yes	Yes	10% DEVIATION	Yes	Yes
AI	DPT	03	DIFFERENTIAL PRESSURE TRANSMITTER	BUILDING LOAD LOOP DP	Yes	Yes	10% DEVIATION	Yes	Yes
AI	DPT	04	DIFFERENTIAL PRESSURE TRANSMITTER	HX LOOP DP	Yes	Yes	10% DEVIATION	Yes	Yes
AI	DPT	05	DIFFERENTIAL PRESSURE TRANSMITTER	HX LOOP DP	Yes	Yes	10% DEVIATION	Yes	Yes
AI	FT	01	FLOW TRANSMITTER	PRIMARY LOOP FLOW				Yes	Yes
AI	FT	02	FLOW TRANSMITTER	AHU COIL LOOP FLOW				Yes	Yes
AI	FT	03	FLOW TRANSMITTER	BUILDING LOAD LOOP FLOW				Yes	Yes
AI	FT	04	FLOW TRANSMITTER	MAKEUP WATER METER					Yes
AI	FT	05	FLOW TRANSMITTER	MAKEUP WATER METER					Yes
AI	PT	01	PRESSURE TRANSMITTER	STEAM SUPPLY					Yes
AI	PT	02	PRESSURE TRANSMITTER	MAKEUP WATER METER					Yes
AI	PT	03	PRESSURE TRANSMITTER	MAKEUP WATER METER					Yes
AI	PT	04	PRESSURE TRANSMITTER	MAKEUP WATER METER					Yes
AI	TT	01	TEMPERATURE TRANSMITTER	HX SECONDARY HHWS	Yes	Yes	+/- 4°F FROM SETPOINT	Yes	Yes
AI	TT	02	TEMPERATURE TRANSMITTER	HHWR TEMP				Yes	Yes
AI	TT	04	TEMPERATURE TRANSMITTER	STEAM SUPPLY				Yes	Yes
AI	TT	05	TEMPERATURE TRANSMITTER	HX SECONDARY HHWS	Yes	Yes	+/- 4°F FROM SETPOINT	Yes	Yes
AI	TT	06	TEMPERATURE TRANSMITTER	AHU COIL LOOP HHWR TEMP				Yes	Yes
AI	TT	07	TEMPERATURE TRANSMITTER	BUILDING LOAD LOOP HHWR TEMP				Yes	Yes
AI	TT	08	TEMPERATURE TRANSMITTER	HHWS TEMP	Yes	Yes	+/- 4°F FROM SETPOINT	Yes	Yes
AI	TT	09	TEMPERATURE TRANSMITTER	HHWS TEMP				Yes	Yes
AI	TT	10	TEMPERATURE TRANSMITTER	BUILDING LOAD HHWS TEMP	Yes	Yes	+/- 4°F FROM SETPOINT	Yes	Yes
AI	TT	11	TEMPERATURE TRANSMITTER	HX PRIMARY SIDE HHWR				Yes	Yes
AI	TT	12	TEMPERATURE TRANSMITTER	HX SECONDARY HHWR				Yes	Yes
AI	TT	13	TEMPERATURE TRANSMITTER	HX PRIMARY SIDE HHWR				Yes	Yes
AI	TT	14	TEMPERATURE TRANSMITTER	HX SECONDARY HHWR				Yes	Yes
AO	FCV	01	FLOW CONTROL VALVE	HHW LOOP MIN FLOW BYPASS VALVE, ePIV				Yes	Yes
AO	FCV	02	FLOW CONTROL VALVE	AHU COIL LOOP MIN FLOW BYPASS VALVE, ePIV				Yes	Yes
AO	FCV	03	FLOW CONTROL VALVE	BUILDING LOAD LOOP MIN FLOW BYPASS VALVE, ePIV				Yes	Yes
AO	SP	01	SETPOINT	SHX-01.2					Yes
DI	AC	01	ALARM CONTACT	SHX-01.2					Yes
DI	HHL	01	HIGH HIGH LEVEL ALARM	CRP ALARM					
DI	HL	01	HIGH LEVEL ALARM	CRP ALARM					
DI	LSL	01	LOW LEVEL ALARM	CRP ALARM					
DO	SS	01	START/STOP	SHX-01.2					Yes
DO	TCV	01	TEMPERATURE CONTROL VALVE	HX PRIMARY SIDE CONTROL VALVE					Yes
DO	TCV	02	TEMPERATURE CONTROL VALVE	HX PRIMARY SIDE CONTROL VALVE					Yes

Grand total: 38

1. REFER TO M9.00, M9.01, AND CORNELL BAS STANDARDS FOR ALL TRENDING, ALARMING, AND GRAPHICS REQUIREMENTS.

3

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

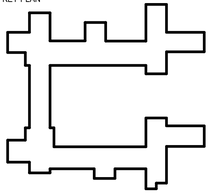
GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	Bulletin #3	08/05/2022

MECHANICAL CONTROLS - STEAM TO HHW - SHEET 2

GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	MJ	DATE: 11/05/2021
CHECKED:	AJ	SCALE: NTS

DRAWING NO.:

M9.06

MECHANICAL CONNECTION SCHEDULE

MOTOR DESIGNATION		MOTOR DATA				BRANCH CIRCUIT			BRANCH WIRING (COPPER THHN/THWN)		STARTER/DISCONNECT TYPE				
EQUIPMENT TYPE	NO.	VOLTAGE (V)	PHASE	FLA	LOAD (kVA)	PANEL	CIRCUIT NUMBER	OCP	SETS	FEEDER	TYPE	NEMA TYPE	RATING	SUPPLIED BY	COMMENTS
DUMBWAITER	1	208	3	10.6	3.82	LEP-OS-311	6,8,10	25 A	1	P30D	DISCONNECT	1	30 A	DIV 26	SEE NOTE 6.
ELEV	1	208	3	32.0	11.53	LEP-LR-501	1,3,5	70 A	1	P55D	DISCONNECT	1	60 A	DIV 26	
ELEV	2	208	3	32.0	11.53	LEP-LR-601	1,3,5	70 A	1	P55D	DISCONNECT	1	60 A	DIV 26	
ELEV	3	208	3	32.0	11.53	LEP-LR-502	1,3,5	70 A	1	P55D	DISCONNECT	1	60 A	DIV 26	
ELEV	4	208	3	32.0	11.53	LEP-LR-602	1,3,5	70 A	1	P55D	DISCONNECT	1	60 A	DIV 26	
PLATFORM LIFT	1	208	1	10.0	2.08	LEP-OS-311	12,14	25 A	1	P30B	DISCONNECT	1	30 A	DIV 26	
MECHANICAL															
AHU	ETR	208	3	30.8	11.10	LEP-OS-204	35,37,39	50 A	1	P55D	DISCONNECT	1	60 A	DIV 26	SEE NOTE 5.
BCU	1	208	1	7.5	1.56	LEP-OS-106	4	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
BCU	2	208	1	7.5	1.56	LEP-OS-204	15,17	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
CHW	1	208	3	30.8	11.10	LEP-OS-204	8,10,12	40 A	1	P55D	VFD	1	60 A	DIV 23	
CHW	2	208	3	0.0	0.00	LEP-OS-204	14,16,18	40 A	1	P55D	VFD	1	60 A	DIV 23	SEE NOTE 7.
CHW	3	208	3	4.6	1.66	LEP-LS-301	13,15,17	20 A	1	P20D	DISCONNECT	1	30 A	DIV 26	
ERV	1	208	3	75.0	27.02	LEP-OS-106	2	100 A	1	P110D	VFD	1	100 A	DIV 23	
ERV	2	208	3	57.0	20.54	LEP-OS-204	2,4,6	80 A	1	P95D	VFD	1	100 A	DIV 23	
GF	2	120	1	2.0	0.24	LEP-OS-204	41	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
GWP	1	208	3	24.2	8.72	LEP-OS-204	43,45,47	40 A	1	P55D	VFD	1	60 A	DIV 23	
GWP	2	208	3	0.0	0.00	LEP-OS-204	20,22,24	40 A	1	P55D	VFD	1	60 A	DIV 23	SEE NOTE 7.
HCP	1	120	1	1.1	0.13	LEP-OS-106	3	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
HCP	2	120	1	1.1	0.13	LEP-OS-204	27	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
HCP	3	120	1	1.1	0.13	LEP-OS-106	6	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
HCP	4	120	1	1.1	0.13	LEP-OS-204	26	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
HCP	5	120	1	1.1	0.13	LEP-OS-204	28	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
HHW	1	208	3	16.7	6.02	LEP-OS-204	42,44,46	30 A	1	P30D	VFD	1	30 A	DIV 23	
HHW	2	208	3	0.0	0.00	LEP-OS-204	36,38,40	30 A	1	P30D	VFD	1	30 A	DIV 23	SEE NOTE 7.
HHW	3	208	3	24.2	8.72	LEP-OS-205	7,9,11	40 A	1	P55D	VFD	1	60 A	DIV 23	
HHW	4	208	3	0.0	0.00	LEP-OS-205	1,3,5	40 A	1	P55D	VFD	1	60 A	DIV 23	SEE NOTE 7.
LX	1	208	1	5.4	1.12	LEP-OS-104	35,37	20 A	1	P20B	VFD	1	20 A	DIV 23	
LX	2	208	1	5.4	1.12	LEP-OS-204	29,31	20 A	1	P20B	VFD	1	20 A	DIV 23	
SCP	1&2	120	1	4.0	0.48	LEP-OS-204	54	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
SHX	1&2	120	1	6.0	0.72	LEP-OS-204	60	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
TX	1	120	1	0.2	0.02	LEP-OS-106	5	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
TX	2	120	1	0.2	0.02	LEP-OS-204	33	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
UH	1-1-1	120	1	1.4	0.17	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-1-2	120	1	4.5	0.54	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-1-3	120	1	1.2	0.14	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-1-4	120	1	1.2	0.14	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-1-5	120	1	0.8	0.10	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-2-1	120	1	1.4	0.17	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	1-2-2	120	1	1.2	0.14	LEP-OS-104	2	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-1-3	120	1	0.8	0.10	LEP-OS-104	25	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-2-1	120	1	0.8	0.10	LEP-OS-104	5	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-2-2	120	1	0.8	0.10	LEP-OS-104	5	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-3-1	120	1	1.4	0.17	LEP-OS-204	23	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-3-2	120	1	0.8	0.10	LEP-OS-204	23	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-1	120	1	1.2	0.14	LEP-OS-204	56	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-2	120	1	1.2	0.14	LEP-OS-204	56	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-3	120	1	0.8	0.10	LEP-OS-204	58	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-4	120	1	0.8	0.10	LEP-OS-204	58	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-5	120	1	0.8	0.10	LEP-OS-204	58	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-6	120	1	0.8	0.10	LEP-OS-204	56	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-7	120	1	0.8	0.10	LEP-OS-204	58	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-8	120	1	1.4	0.17	LEP-OS-204	56	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	2-4-9	120	1	1.4	0.17	LEP-OS-204	56	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-2-1	120	1	0.8	0.10	LEP-OS-605	13	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-3-1	120	1	0.8	0.10	LEP-OS-204	5	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-3-2	120	1	0.8	0.10	LEP-OS-409	21	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-4-1	120	1	1.4	0.17	LEP-OS-311	31	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-4-2	120	1	0.8	0.10	LEP-OS-311	29	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-4-3	120	1	1.4	0.17	LEP-OS-311	27	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	3-4-4	120	1	0.8	0.10	LEP-OS-311	25	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	4-2-1	120	1	0.8	0.10	LEP-OS-605	13	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	4-3-1	120	1	0.8	0.10	LEP-OS-409	21	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	5-2-1	120	1	0.8	0.10	LEP-OS-605	13	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
UH	6-2-1	120	1	0.8	0.10	LEP-OS-605	13	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTE 3.
PLUMBING															
DWH	1	120	1	1.5	0.18	LEP-OS-104	30	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
EEP	1	120	1	4.0	0.48	LEP-LS-101	3	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTES 3, 4.
HWP	1	120	1	1.5	0.18	LEP-OS-104	26	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
HWP	2	120	1	1.5	0.18	LEP-OS-104	26	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
HWP	3	120	1	1.5	0.18	LEP-OS-104	28	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
HWP	4	120	1	1.5	0.18	LEP-OS-104	28	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
NGS	1	208	1	5.2	1.08	LEP-OS-104	20,22	20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	
NGS	2	208	1	5.2	1.08			20 A	1	P20B	DISCONNECT	1	30 A	DIV 26	SEE NOTES 3, 4.
PVA	1	120	1	1.5	0.18	LEP-LS-101	7	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	
SP	1	120	1	1.0	0.12	LEP-LS-101	9	20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTES 3, 4.
TEP	1	208	1	6.6	1.37			20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTES 3, 4.
TP	2	120	1	0.5	0.06			20 A	1	P20B	THERMAL SWITCH	1	20 A	DIV 26	SEE NOTES 3, 4.

MECHANICAL CONNECTION SCHEDULE NOTES:

1. EC SHALL COORDINATE THE LOCATION OF ALL DISCONNECTS FOR MECHANICAL EQUIPMENT WITH MC PRIOR TO ROUGH IN. LOCATIONS SHOWN ON ELECTRICAL FLOOR PLANS ARE FOR REFERENCE ONLY.
2. ALL DISCONNECTS SHALL BE INSTALLED BY DIV 26.
3. TYPICAL ELECTRICAL INFORMATION. REFER TO MECHANICAL/PLUMBING DRAWINGS FOR EXACT QUANTITIES AND LOCATIONS OF EQUIPMENT.
4. TYPICAL EQUIPMENT NUMBERS CORRESPOND TO THOSE ON MECHANICAL/PLUMBING SCHEDULES.
5. THIS EQUIPMENT IS EXISTING AND SHALL BE REFED FROM NEW ELECTRICAL DISTRIBUTION FROM APPROPRIATE SOURCE PANEL WITH OVERCURRENT PROTECTION MATCHING EXISTING.
6. THIS EQUIPMENT IS ADD ALTERNATE.
7. PUMP IS A STANDBY UNIT TO IDENTICAL DUTY PUMP OF PAIRING WITH NON-COINCIDENTAL LOADS. IT IS SCHEDULED AT NO LOAD FOR PURPOSE OF ELECTRICAL LOAD CALCULATIONS AND IS RATED THE SAME AS OTHER PUMP IN NUMBERED PAIRING.

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

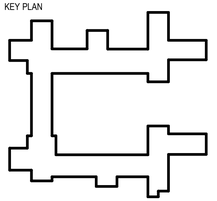
GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	BULLETIN #3	8/5/2022

ELECTRICAL SCHEDULES SHEET 2

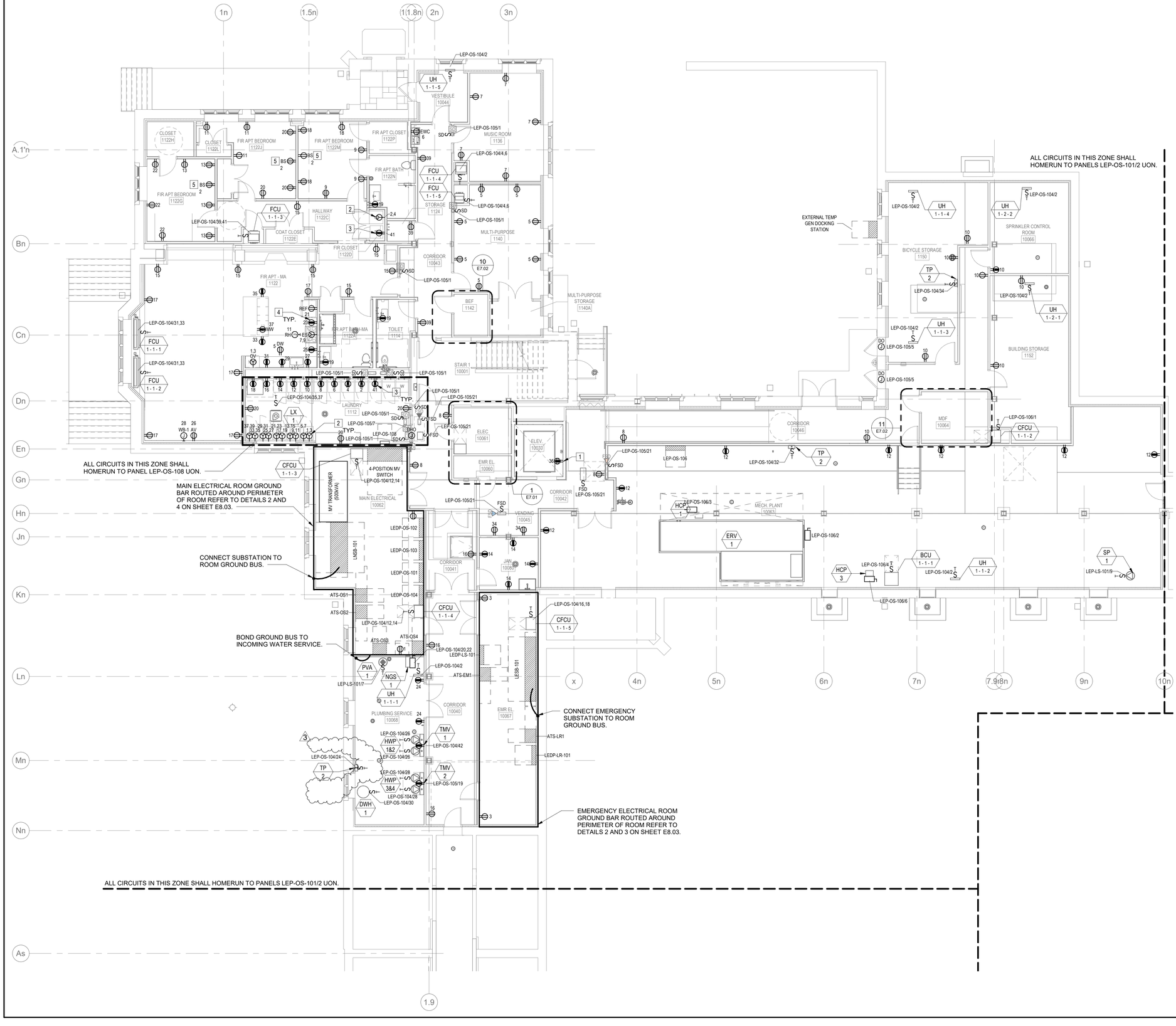
GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	JP	DATE: 11/05/2021
CHECKED:	JT	SCALE: NTS

DRAWING NO.:

E0.03



GENERAL SHEET NOTES:

1. DEVICE INSTALLATION MAY BE IMPACTED BY EXISTING TO REMAIN CONDITIONS AND SHALL BE FIELD MODIFIED AS NEEDED.
2. GENERAL CONTRACTOR SHALL COORDINATE BETWEEN MECHANICAL, TELECOM, AUDIOVISUAL, AND SECURITY PLANS FOR POWER OUTLET REQUIREMENTS. ANY CONFLICTS WITH POWER PLANS SHALL BE REVIEWED WITH ARCHITECT.
3. OFFICE, CORRIDOR, AND DORMITORY RECEPTACLES SHALL BE TAMPER-RESISTANT TYPE PER NEC 406.12.
4. EC SHALL COORDINATE EXACT LOCATIONS OF RECEPTACLES IN DORMITORY BEDROOMS TO COORDINATE WITH FINAL ARCHITECTURAL LAYOUT WHILE COMPLYING TO NEC 210.52.
5. MA TYPE BEDROOMS SHALL RECEIVE TWO CIRCUITS PER OCCUPANT. ALL OTHERS SHALL RECEIVE ONE CIRCUIT PER OCCUPANT.
6. CONCEAL ALL CONDUITS WITHIN EXISTING AND NEW WALLS. WHEN UNABLE TO CONCEAL CONDUITS WITHIN EXISTING MASONRY WALLS, MAKE EVERY EFFORT TO ROUTE CONDUITS IN ORDER TO LIMIT VISIBILITY OF EXPOSED CONDUITS. TRENCH/CORE EXISTING MASONRY WALLS IN ORDER TO CONCEAL CONDUITS.
7. ALL RECEPTACLES SHALL BE DECORA STYLE.

KEYNOTES

#	NOTE
1	PROVIDE 120V, 20A 1P GFCI RECEPTACLE ON DEDICATED CIRCUIT. RECEPTACLE SHALL BE UNSWITCHED.
2	PROVIDE 208V, 30A 1P DEDICATED CIRCUIT FOR CLOTHES DRYER.
3	PROVIDE 120V, 1P DEDICATED CIRCUIT FOR WASHING MACHINE.
4	ALL KITCHEN RECEPTACLES SHALL BE ON DEDICATED 120V, 20A CIRCUITS.
5	FOR BED SHAKER IN HEARING-ACCESSIBLE OCCUPANCY. PROVIDE 120V EMERGENCY POWER CIRCUIT FROM EMERGENCY PANEL SERVING RESPECTIVE FLOOR AND QUADRANT. BED SHAKER SHALL BE CONNECTED TO ASSOCIATED FIRE ALARM ADDRESSABLE OUTPUT MODULE, COORDINATE CONNECTION REQUIREMENTS WITH MANUFACTURER PRIOR TO INSTALLATION. COORDINATE ADDITIONAL REQUIREMENTS WITH FIRE ALARM DRAWINGS.

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	BULLETIN #3	8/5/2022

ELECTRICAL POWER FIRST FLOOR PLAN - A

GOODY CLANCY PROJECT NUMBER07400

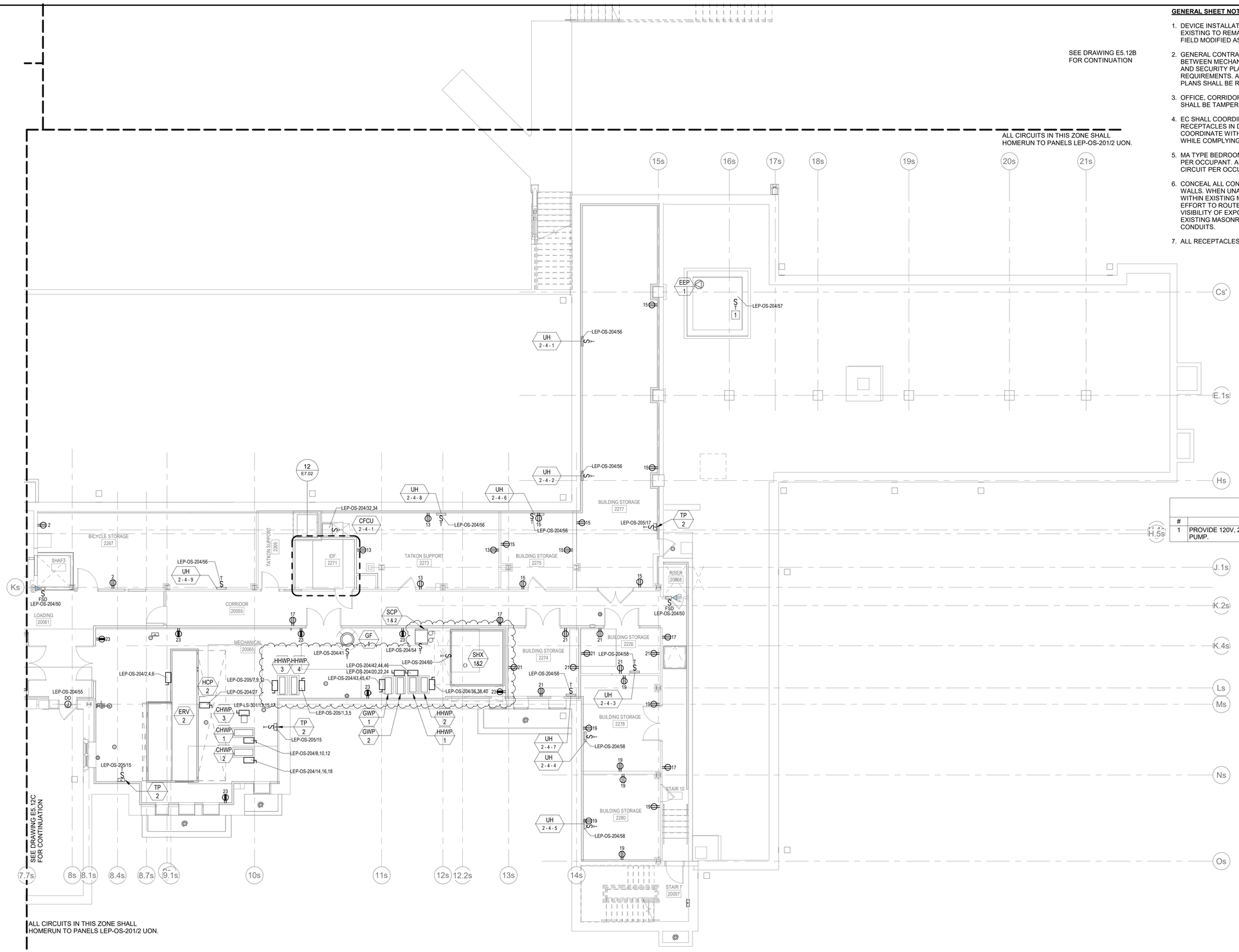
FILE NAME:

DRAWN:	JP	DATE: 11/05/2021
CHECKED:	JT	SCALE: 1/8" = 1'-0"

DRAWING NO.:

E5.11A

8/5/2022 3:45:48 PM
C:\Users\michael.shearer\Documents\Revit\Local Files\E-FA_07400-Cornell-Balch_R21_michael.shearer.rvt



GENERAL SHEET NOTES:

1. DEVICE INSTALLATION MAY BE IMPACTED BY EXISTING TO REMAIN CONDITIONS AND SHALL BE FIELD MODIFIED AS NEEDED.
2. GENERAL CONTRACTOR SHALL COORDINATE BETWEEN MECHANICAL, TELECOM, AUDIOVISUAL, AND SECURITY PLANS FOR POWER OUTLET REQUIREMENTS. ANY CONFLICTS WITH POWER PLANS SHALL BE REVIEWED WITH ARCHITECT.
3. OFFICE, CORRIDOR, AND DORMITORY RECEPTACLES SHALL BE TAMPER-RESISTANT TYPE PER NEC 406.12.
4. EC SHALL COORDINATE EXACT LOCATIONS OF RECEPTACLES IN DORMITORY BEDROOMS TO COORDINATE WITH FINAL ARCHITECTURAL LAYOUT WHILE COMPLYING TO NEC 210.52.
5. MA TYPE BEDROOMS SHALL RECEIVE TWO CIRCUITS PER OCCUPANT. ALL OTHERS SHALL RECEIVE ONE CIRCUIT PER OCCUPANT.
6. CONCEAL ALL CONDUITS WITHIN EXISTING AND NEW WALLS. WHEN UNABLE TO CONCEAL CONDUITS WITHIN EXISTING MASONRY WALLS, MAKE EVERY EFFORT TO ROUTE CONDUITS IN ORDER TO LIMIT VISIBILITY OF EXPOSED CONDUITS. TRENCH/CORE EXISTING MASONRY WALLS IN ORDER TO CONCEAL CONDUITS.
7. ALL RECEPTACLES SHALL BE DECORA STYLE.

KEYNOTES

#	NOTE
1	PROVIDE 120V, 20A 1P CIRCUIT FOR EJECTOR PUMP.

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP

Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

N

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	BULLETIN #3	8/5/2022

ELECTRICAL POWER SECOND FLOOR PLAN - D

GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN:	JP	DATE: 11/05/2021
CHECKED:	JT	SCALE: 1/8" = 1'-0"

DRAWING NO.:

E5.12D

GENERAL SHEET NOTES:

1. PROVIDE APPROPRIATE SPARE BREAKERS FOR EACH PANEL WHERE SPACES ARE SHOWN FOR PRICING PURPOSES. A MINIMUM OF 25% SPARE SHALL BE PROVIDED IN EACH PANELBOARD PER CORNELL STANDARDS.
2. ALL BRANCH CIRCUITS SUPPLYING OUTLETS AND DEVICES INSTALLED FOR DORMITORY SPACES SHALL BE PROTECTED BY AFCI BREAKERS PER NEC 210.12(B) UON.

PANEL: LEP-OS-105

LOCATION: ELEC 1061 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.24 cal/cm^2
SUPPLY FROM: LEP-OS-104 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **FEED THROUGH PANEL**
CALCULATED FAULT CURRENT: 4995 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - SD FLOOR 1A		20 A	1	400 VA	0 VA					1	20 A		SPARE	2
3	Motor - SD FLOOR 2B		20 A	1			1050 VA	0 VA			1	20 A		SPARE	4
5	Equipment - DOOR OPERATORS 1A		20 A	1					1000 VA	0 VA	1	20 A		SPARE	6
7	Equipment - DOOR HOLD OPEN 1A		20 A	1	500 VA	0 VA					1	20 A		SPARE	8
9	Equipment - DOOR HOLD OPEN 2A		20 A	1			1000 VA	0 VA			1	20 A		SPARE	10
11	Equipment - DOOR OPERATORS 2A		20 A	1					1000 VA	0 VA	1	20 A		SPARE	12
13	Equipment - DOOR HOLD...		20 A	1	1500 VA	0 VA					1	20 A		SPARE	14
15	Motor - SD FLOOR 2A		20 A	1			600 VA	0 VA			1	20 A		SPARE	16
17	Motor - EEP ELEV 2		20 A	1					480 VA	0 VA	1	20 A		SPARE	18
19	Receptacle - TMV 2		20 A	1	180 VA	0 VA					1	20 A		SPARE	20
21	Motor - FSD FLOOR 1A		20 A	1			450 VA	0 VA			1	20 A		SPARE	22
23	Motor - FSD FLOOR 2A		20 A	1					350 VA	0 VA	1	20 A		SPARE	24
25	Motor - FSD FLOOR 2B		20 A	1	250 VA	0 VA					1	20 A		SPARE	26
27	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	28
29	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	30
31	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	32
33	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	34
35	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	36
37	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	38
39	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	40
41	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		2830 VA		3100 VA		2830 VA						
			TOTAL AMPS:		24 A		26 A		24 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	5000 VA	100.00%	5000 VA		
Motor	3580 VA	103.35%	3700 VA	TOTAL CONN. LOAD:	8760 VA
Receptacle	180 VA	100.00%	180 VA	TOTAL EST. DEMAND:	8880 VA
				TOTAL CONN.:	24 A
				TOTAL EST. DEMAND:	25 A

NOTES:

PANEL: LEP-OS-104

LOCATION: ELEC 1061 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.24 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 4995 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU - FLOOR 2 -...		20 A	2	281 VA	1404 VA					1	20 A		Motor - UH - FLOOR 1A	2
3	--		--	--			281 VA	187 VA			2	20 A		Motor - FCU - MUSIC ROOM,...	4
5	Motor - UH - STAIR 3		20 A	1					192 VA	187 VA	--	--		--	6
7	Motor - FCU - FLOOR 2 -...		20 A	2	281 VA	0 VA					2	20 A		SPARE	8
9	--		--	--			281 VA	0 VA			--	--		--	10
11	Motor - FCU - FLOOR 2 -...		20 A	2					468 VA	250 VA	2	20 A		Motor - CFCU - MAIN ELECTRICA...	12
13	--		--	--	468 VA	250 VA					--	--		--	14
15	Motor - FCU - FLOOR 2 LOUNGES...		20 A	2			468 VA	125 VA			2	20 A		Motor - CFCU - ELECTRICAL 1107	16
17	--		--	--					468 VA	125 VA	--	--		--	18
19	SPARE		20 A	1	0 VA	541 VA					2	20 A		Motor - NGS - PLUMBING SERVIC...	20
21	Motor - FCU - UNIT 1 LOUNGE		20 A	2			374 VA	541 VA			--	--		--	22
23	--		--	--					374 VA	60 VA	1	20 A		Motor - TP-2 PLUMBING SERVICE	24
25	Motor - UH - UNIT 1 VESTIBULE		20 A	1	96 VA	360 VA					1	20 A		Motor - HWP 1&2 - PLUMBING...	26
27	Motor - FCU - FLOOR 2 -...		20 A	2			187 VA	360 VA			1	20 A		Motor - HWP 3&4 - PLUMBING...	28
29	--		--	--					187 VA	180 VA	1	20 A		Motor - DWH 1 - PLUMBING...	30
31	Motor - FCU - FIR APT LIVING...		20 A	2	374 VA	60 VA					1	20 A		Motor - TP-2 MECH. PLANTS 1113	32
33	--		--	--			374 VA	60 VA			1	20 A		Motor - TP-2 BICYCLE STORAGE	34
35	Motor - LX-1 - LAUNDRY 1112		20 A	2					562 VA	125 VA	2	20 A		Motor - CFCU - ELEC 1061	36
37	--		--	--	562 VA	125 VA					--	--		--	38
39	Motor - FCU - FIR APT BEDROOMS		20 A	2			104 VA	60 VA			1	20 A		Motor - TP-2 FLOOR 2B TUNNEL	40
41	--		--	--					104 VA	180 VA	1	20 A		Receptacle - TMV 1	42
			TOTAL LOAD:		7631 VA		6502 VA		6292 VA						
			TOTAL AMPS:		64 A		54 A		52 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	5000 VA	100.00%	5000 VA		
Motor	15065 VA	101.86%	15346 VA	TOTAL CONN. LOAD:	20425 VA
Receptacle	360 VA	100.00%	360 VA	TOTAL EST. DEMAND:	20706 VA
				TOTAL CONN.:	57 A
				TOTAL EST. DEMAND:	57 A

NOTES:

PANEL: LEP-OS-309

LOCATION: ELEC 3060 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.21 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 4402 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU - FLOOR 4 -...		20 A	2	499 VA	1000 VA					1	20 A		Equipment - DOOR HOLD OPEN 4A	2
3	--		--	--			499 VA	550 VA			1	20 A		Motor - SD FLOOR 3A	4
5	Motor - FCU - FLOOR 4 -...		20 A	2					312 VA	450 VA	1	20 A		Motor - SD FLOOR 3A	6
7	--		--	--	312 VA	750 VA					1	20 A		Motor - SD FLOOR 4A	8
9	Motor - FCU - FLOOR 4 -...		20 A	2			343 VA	600 VA			1	20 A		Motor - SD FLOOR 4A	10
11	--		--	--					343 VA	100 VA	1	20 A		Motor - SD FLOOR 4A	12
13	Motor - FCU - LOUNGE 4143		20 A	2	94 VA	250 VA					1	20 A		Motor - FSD FLOOR 3A	14
15	--		--	--			94 VA	300 VA			1	20 A		Motor - FSD FLOOR 4A	16
17	Motor - FCU - FLOOR 3 -...		20 A	2					468 VA	0 VA	1	20 A		SPARE	18
19	--		--	--	468 VA	0 VA					1	20 A		SPARE	20
21	Motor - FCU - FLOOR 3 -...		20 A	2			281 VA	0 VA			1	20 A		SPARE	22
23	--		--	--					281 VA	0 VA	1	20 A		SPARE	24
25	Motor - FCU - FLOOR 3 -...		20 A	2	187 VA	0 VA					1	20 A		SPARE	26
27	--		--	--			187 VA	0 VA			1	20 A		SPARE	28
29	Motor - FCU - FLOOR 3 -...		20 A	2					374 VA	0 VA	1	20 A		SPARE	30
31	--		--	--	374 VA	0 VA					1	20 A		SPARE	32
33	Motor - FCU - LOUNGE 3143		20 A	2			187 VA	0 VA			1	20 A		SPARE	34
35	--		--	--					187 VA	0 VA	1	20 A		SPARE	36
37	Motor - CFCU - IT IDF 4152		20 A	2	125 VA	0 VA					1	20 A		SPARE	38
39	--		--	--			125 VA	0 VA			1	20 A		SPARE	40
41	Equipment - DOOR HOLD OPEN 3A		20 A	1					1000 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		4059 VA		3166 VA		3516 VA						
			TOTAL AMPS:		34 A		26 A		30 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	2000 VA	100.00%	2000 VA		
Motor	8741 VA	100.71%	8803 VA	TOTAL CONN. LOAD:	10741 VA
				TOTAL EST. DEMAND:	10803 VA
				TOTAL CONN.:	30 A
				TOTAL EST. DEMAND:	30 A

NOTES:

PANEL: LEP-OS-509

LOCATION: | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.19 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 3930 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2	374 VA	0 VA					1	20 A		SPARE	2
3	--		--	--			374 VA	0 VA			1	20 A		SPARE	4
5	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2					250 VA	0 VA	1	20 A		SPARE	6
7	--		--	--	250 VA	0 VA					1	20 A		SPARE	8
9	Motor - FCU - LOUNGE 5112		20 A	2			94 VA	0 VA			1	20 A		SPARE	10
11	--		--	--					94 VA	0 VA	1	20 A		SPARE	12
13	Equipment - DOOR HOLD OPEN 5A		20 A	1	500 VA	0 VA					1	20 A		SPARE	14
15	Motor - FSD FLOOR 5A		20 A	1			100 VA	0 VA			1	20 A		SPARE	16
17	Motor - NGS 2 - FLOOR 5A		20 A	2					541 VA	0 VA	1	20 A		SPARE	18
19	--		--	--	541 VA	0 VA					1	20 A		SPARE	20
21	Motor - NGS 2 - FLOOR 5A		20 A	2			541 VA	0 VA			1	20 A		SPARE	22
23	--		--	--					541 VA	0 VA	1	20 A		SPARE	24
25	Motor - SD FLOOR 5A		20 A	1	900 VA	0 VA					1	20 A		SPARE	26
27	Motor - SD FLOOR 5A		20 A	1			900 VA	0 VA			1	20 A		SPARE	28
29	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	30
31	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	32
33	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	34
35	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	36
37	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	38
39	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	40
41	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		2565 VA		2009 VA		1425 VA						
			TOTAL AMPS:		22 A		17 A		12 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	500 VA	100.00%	500 VA		
Motor	5498 VA	104.92%	5769 VA	TOTAL CONN. LOAD:	5998 VA
				TOTAL EST. DEMAND:	6269 VA
				TOTAL CONN.:	17 A
				TOTAL EST. DEMAND:	17 A

NOTES:

PANEL: LEP-OS-310

LOCATION: ELEC 3228 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.13 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 2620 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU - FLOOR 4 -...		20 A	2	468 VA	1500 VA					1	20 A		Equipment - DOOR HOLD OPEN 4B	2
3	--		--	--			468 VA	850 VA			1	20 A		Motor - SD FLOOR 3B	4
5	Motor - FCU - FLOOR 4 -...		20 A	2					281 VA	450 VA	1	20 A		Motor - SD FLOOR 3B	6
7	--		--	--	281 VA	950 VA					1	20 A		Motor - SD FLOOR 4B	8
9	Motor - FCU - FLOOR 4 -...		20 A	2			281 VA	750 VA			1	20 A		Motor - SD FLOOR 4B	10
11	--		--	--					281 VA	300 VA	1	20 A		Motor - FSD FLOOR 3B	12
13	Motor - FCU - FLOOR 4 -...		20 A	2	187 VA	150 VA					1	20 A		Motor - FSD FLOOR 4B	14
15	--		--	--			187 VA	150 VA			1	20 A		Motor - FSD FLOOR 4B	16
17	Motor - FCU - LOUNGE 4176		20 A	2					94 VA	0 VA	1	20 A		SPARE	18
19	--		--	--	94 VA	0 VA					1	20 A		SPARE	20
21	Motor - FCU - STUDY 3176		20 A	2			374 VA	0 VA			1	20 A		SPARE	22
23	--		--	--					374 VA	0 VA	1	20 A		SPARE	24
25	Motor - FCU - UNIT 2 LOUNGE		20 A	2	562 VA	0 VA					1	20 A		SPARE	26
27	--		--	--			562 VA	0 VA			1	20 A		SPARE	28
29	Motor - FCU - FLOOR 3 -...		20 A	2					281 VA	0 VA	1	20 A		SPARE	30
31	--		--	--	281 VA	0 VA					1	20 A		SPARE	32
33	Motor - FCU - FLOOR 3 -...		20 A	2			374 VA	0 VA			1	20 A		SPARE	34
35	--		--	--					374 VA	0 VA	1	20 A		SPARE	36
37	Motor - FCU - FLOOR 3 -...		20 A	2	187 VA	0 VA					1	20 A		SPARE	38
39	--		--	--			187 VA	0 VA			1	20 A		SPARE	40
41	Equipment - DOOR HOLD OPEN 3B		20 A	1					1500 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		4659 VA		4184 VA		3935 VA						
			TOTAL AMPS:		39 A		35 A		33 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	3000 VA	100.00%	3000 VA		
Motor	9778 VA	100.96%	9871 VA	TOTAL CONN. LOAD:	12778 VA
				TOTAL EST. DEMAND:	12871 VA
				TOTAL CONN.:	35 A
				TOTAL EST. DEMAND:	36 A

NOTES:

PANEL: LEP-OS-605

LOCATION: | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.13 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 2466 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU FLOOR 6 - BEDROOMS		20 A	2	374 VA	200 VA					1	20 A		Motor - FSD FLOOR 5B	2
3	--		--	--			374 VA	100 VA			1	20 A		Motor - FSD FLOOR 6B	4
5	Motor - FCU FLOOR 6 - BEDROOMS		20 A	2					250 VA	200 VA	1	20 A		Motor - FSD FLOOR 6D	6
7	--		--	--	250 VA	541 VA					2	20 A		Motor - NGS 2 - FLOOR 6B	8
9	Motor - FCU - LOUNGE 6176		20 A	2			94 VA	541 VA			--	--		--	10
11	--		--	--					94 VA	0 VA	1	20 A		SPARE	12
13	Motor - UH - STAIR 4		20 A	1	384 VA	0 VA					1	20 A		SPARE	14
15	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2			187 VA	0 VA			1	20 A		SPARE	16
17	--		--	--					187 VA	0 VA	1	20 A		SPARE	18
19	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2	281 VA	0 VA					1	20 A		SPARE	20
21	--		--	--			281 VA	0 VA			1	20 A		SPARE	22
23	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2					281 VA	0 VA	1	20 A		SPARE	24
25	--		--	--	281 VA	0 VA					1	20 A		SPARE	26
27	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2			250 VA	0 VA			1	20 A		SPARE	28
29	--		--	--					250 VA	0 VA	1	20 A		SPARE	30
31	Motor - FCU - LOUNGE 5176		20 A	2	94 VA	0 VA					1	20 A		SPARE	32
33	--		--	--			94 VA	0 VA			1	20 A		SPARE	34
35	Equipment - DOOR HOLD OPEN 5B		20 A	1					1500 VA	0 VA	1	20 A		SPARE	36
37	Motor - SD FLOOR 5B		20 A	1	1250 VA	0 VA					1	20 A		SPARE	38
39	Motor - SD FLOOR 5B		20 A	1			800 VA	0 VA			1	20 A		SPARE	40
41	Motor - SD FLOOR 6B		20 A	1					550 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		3654 VA		2720 VA		3311 VA						
			TOTAL AMPS:		31 A		23 A		28 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	1500 VA	100.00%	1500 VA		
Motor	8185 VA	103.30%	8455 VA	TOTAL CONN. LOAD:	9685 VA
				TOTAL EST. DEMAND:	9955 VA
				TOTAL CONN.:	27 A
				TOTAL EST. DEMAND:	28 A

NOTES:

CORNELL UNIVERSITY FOUNDED A.D. 1865

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN

100% Construction Documents

ISSUED: **11/05/2021**

REVISIONS

3	BULLETIN #3	8/5/2022

ELECTRICAL PANEL SCHEDULES SHEET 12

GOODY CLANCY PROJECT NUMBER07400

FILE NAME:

DRAWN: JP DATE: 11/05/2021

CHECKED: JT SCALE: NTS

DRAWING NO.:

E9.12

GENERAL SHEET NOTES:

1. PROVIDE APPROPRIATE SPARE BREAKERS FOR EACH PANEL WHERE SPACES ARE SHOWN FOR PRICING PURPOSES. A MINIMUM OF 25% SPARE SHALL BE PROVIDED IN EACH PANELBOARD PER CORNELL STANDARDS.
2. ALL BRANCH CIRCUITS SUPPLYING OUTLETS AND DEVICES INSTALLED FOR DORMITORY SPACES SHALL BE PROTECTED BY AFCI BREAKERS PER NEC 210.12(B) UON.

PANEL: LEP-OS-204

LOCATION: EMG EL. 2336 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.14 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 400 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 400 A
CALCULATED FAULT CURRENT: 2708 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU - FLOOR 3 -...		20 A	2	281 VA	6845 VA					3	80 A		Motor - ERV 2 - MECHANICAL 2069	2
3	--		--	--			281 VA	6845 VA			--	--		--	4
5	Motor - UH - STAIR 5		20 A	1					96 VA	6845 VA	--	--		--	6
7	Motor - FCU - UNIT 3 LOUNGE		20 A	2	374 VA	3699 VA					3	40 A		Motor - CHW 1 - MECHANICAL 2069	8
9	--		--	--			374 VA	3699 VA			--	--		--	10
11	Motor - FCU - FLOOR 2 -...		20 A	2					281 VA	3699 VA	--	--		--	12
13	--		--	--	281 VA	0 VA					3	40 A		Motor - CHW 2 - MECHANICAL 2069	14
15	Motor - BCU 2 - LOUNGE 2245		20 A	2			780 VA	0 VA			--	--		--	16
17	--		--	--					780 VA	0 VA	--	--		--	18
19	Motor - FCU - LOUNGE 2210		20 A	2	374 VA	0 VA					3	20 A		Motor - GWP 2 - MECHANICAL 2069	20
21	--		--	--			374 VA	0 VA			--	--		--	22
23	Motor - UH - UNIT 3		20 A	1					264 VA	0 VA	--	--		--	24
25	Motor - SD FLOOR 3C		20 A	1	200 VA	132 VA					1	20 A		Motor - HCP 4	26
27	Motor - HCP 2		20 A	1			132 VA	132 VA			1	20 A		Motor - HCP 5	28
29	Motor - LX-2		20 A	2					562 VA	250 VA	1	20 A		Motor - FSD FLOOR 3C	30
31	--		--	--	562 VA	125 VA					2	20 A		Motor - CFCU - IDF 2271	32
33	Motor - TX 2 - SOUTH BALCH		20 A	1			24 VA	125 VA			--	--		--	34
35	Motor - AHU - TATKON		50 A	3					3699 VA	0 VA	3	30 A		HHWP 2 - MECH SOUTH BALCH	36
37	--		--	--	3699 VA	0 VA					--	--		--	38
39	--		--	--			3699 VA	0 VA			--	--		--	40
41	Motor - GF 2 - MECHANICAL 2069		20 A	1					240 VA	2005 VA	3	30 A		HHWP 1 - MECH SOUTH BALCH	42
43	GWP 1 - MECH. SOUTH BALCH		20 A	3	2906 VA	2005 VA					--	--		--	44
45	--		--	--			2906 VA	2005 VA			--	--		--	46
47	--		--	--					2906 VA	600 VA	1	20 A		Motor - FSD FLOOR 1C/D	48
49	Equipment - DOOR OPERATORS 2C		20 A	1	1000 VA	300 VA					1	20 A		Motor - FSD FLOOR 2C/D	50
51	Equipment - DOOR HOLD OPEN 2C		20 A	1			500 VA	300 VA			1	20 A		Motor - SD FLOOR 2C	52
53	Equipment - DOOR OPERATORS 2C		20 A	1					1500 VA	480 VA	1	20 A		Motor - SCR 1&2	54
55	Equipment - DOOR OPERATORS 2D		20 A	1	500 VA	720 VA					1	20 A		Motor - UH - FLOOR 2D BOH	56
57	Motor - EEP ELEV 4		20 A	1			480 VA	384 VA			1	20 A		Motor - UH - FLOOR 2D BOH	58
59	Motor - EEP ELEV 3		20 A	1					480 VA	720 VA	1	20 A		Motor - SHX 1&2 - MECH SOUTH...	60
			TOTAL LOAD:		26969 VA		26067 VA		28373 VA						
			TOTAL AMPS:		226 A		217 A		238 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	3500 VA	100.00%	3500 VA		
Motor	77909 VA	106.59%	83042 VA	**TOTAL CONN. LOAD:**	81409 VA
				TOTAL EST. DEMAND:	86542 VA
				TOTAL CONN.:	226 A
				TOTAL EST. DEMAND:	240 A

NOTES:

PANEL: LEP-OS-205

LOCATION: EMG EL. 2336 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.14 cal/cm^2
SUPPLY FROM: LEP-OS-204 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 400 A
ENCLOSURE: TYPE 1 | **FEED THROUGH PANEL**
CALCULATED FAULT CURRENT: 2708 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	HHWP 4 - MECH SOUTH BALCH		40 A	3	0 VA	0 VA					1	20 A		SPARE	2
3	--		--	--			0 VA	0 VA			1	20 A		SPARE	4
5	--		--	--					0 VA	0 VA	1	20 A		SPARE	6
7	HHWP 3 - MECH SOUTH BALCH		20 A	3	2906 VA	0 VA					1	20 A		SPARE	8
9	--		--	--			2906 VA	0 VA			1	20 A		SPARE	10
11	--		--	--					2906 VA	0 VA	1	20 A		SPARE	12
13	Motor - TP-2 TRASH/RECYCLE		20 A	1	60 VA	0 VA					1	20 A		SPARE	14
15	Motor - TP-2 SOUTH BALCH MEC...		20 A	1			120 VA	0 VA			1	20 A		SPARE	16
17	Motor - TP-2 BUILDING STORAGE...		20 A	1					60 VA	0 VA	1	20 A		SPARE	18
19	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	20
21	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	22
23	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	24
25	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	26
27	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	28
29	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	30
31	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	32
33	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	34
35	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	36
37	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	38
39	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	40
41	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	42
43	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	44
45	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	46
47	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	48
49	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	50
51	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	52
53	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	54
55	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	56
57	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	58
59	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	60
			TOTAL LOAD:		2966 VA		3026 VA		2966 VA						
			TOTAL AMPS:		25 A		25 A		25 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Motor	8958 VA	124.33%	11138 VA		
				TOTAL CONN. LOAD:	8958 VA
				TOTAL EST. DEMAND:	11138 VA
				TOTAL CONN.:	25 A
				TOTAL EST. DEMAND:	31 A

NOTES:

PANEL: LEP-OS-311

LOCATION: BATH A 3286 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.14 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 2852 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU - FLOOR 4 -...		20 A	2	374 VA	261 VA					2	20 A		Motor - FCU - FLOOR 3 -...	2
3	--		--	--			374 VA	261 VA			--	--		--	4
5	Motor - FCU - FLOOR 4 -...		20 A	2					374 VA	1273 VA	3	25 A		Motor - TATKON DUMBWAITER	6
7	--		--	--	374 VA	1273 VA					--	--		--	8
9	Motor - FCU - FLOOR 4 -...		20 A	2			281 VA	1273 VA			--	--		--	10
11	--		--	--					281 VA	1040 VA	2	20 A		Motor - PLATFORM LIFT	12
13	Motor - FCU - FLOOR 4 -...		20 A	2	374 VA	1040 VA					--	--		--	14
15	--		--	--			374 VA	125 VA			2	20 A		Motor - CFCU - IDF 4263	16
17	Motor - FCU - FLOOR 4 -...		20 A	2					281 VA	125 VA	--	--		--	18
19	--		--	--	281 VA	1000 VA					1	20 A		Equipment - DOOR HOLD OPEN 3D	20
21	Motor - FCU - LOUNGE 4277		20 A	2			187 VA	1000 VA			1	20 A		Equipment - DOOR HOLD OPEN 4D	22
23	--		--	--					187 VA	1000 VA	1	20 A		Motor - SD FLOOR 3D	24
25	Motor - UH - STAIR 7		20 A	1	96 VA	800 VA					1	20 A		Motor - SD FLOOR 4D	26
27	Motor - UH - TATKON VESTIBULE		20 A	1			168 VA	900 VA			1	20 A		Motor - SD FLOOR 4D	28
29	Motor - UH - STAIR 8		20 A	1					96 VA	450 VA	1	20 A		Motor - SD FLOOR 4D	30
31	Motor - UH - STAIR 9		20 A	1	168 VA	1050 VA					1	20 A		Motor - SD FLOOR 5D	32
33	Motor - FCU - FLOOR 3 -...		20 A	2			468 VA	1150 VA			1	20 A		Motor - SD FLOOR 5D	34
35	--		--	--					468 VA	300 VA	1	20 A		Motor - FSD FLOOR 4D	36
37	Motor - FCU - FLOOR 3 -...		20 A	2	187 VA	800 VA					1	20 A		Motor - SD FLOOR 3D	38
39	--		--	--			187 VA	200 VA			1	20 A		Motor - FSD FLOOR 3D	40
41	Equipment - DOOR OPERATOR 3D		20 A	1					1000 VA	0 VA	1	20 A		SPARE	42
43	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	44
45	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	46
47	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	48
49	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	50
51	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	52
53	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	54
55	SPARE		20 A	1	0 VA	0 VA					1	20 A		SPARE	56
57	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	58
59	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	60
			TOTAL LOAD:		8099 VA		6969 VA		6875 VA						
			TOTAL AMPS:		68 A		58 A		57 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	3000 VA	100.00%	3000 VA		
Motor	18942 VA	105.04%	19897 VA	**TOTAL CONN. LOAD:**	21942 VA
				TOTAL EST. DEMAND:	22897 VA
				TOTAL CONN.:	61 A
				TOTAL EST. DEMAND:	64 A

NOTES:

PANEL: LEP-OS-409

LOCATION: ELEC 4067 | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.13 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 2518 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2	499 VA	0 VA					1	20 A		SPARE	2
3	--		--	--			499 VA	0 VA			1	20 A		SPARE	4
5	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2					125 VA	0 VA	1	20 A		SPARE	6
7	--		--	--	125 VA	0 VA					1	20 A		SPARE	8
9	Motor - FCU - FLOOR 4 -...		20 A	2			655 VA	0 VA			1	20 A		SPARE	10
11	--		--	--					655 VA	0 VA	1	20 A		SPARE	12
13	Motor - FCU - FLOOR 4 -...		20 A	2	374 VA	0 VA					1	20 A		SPARE	14
15	--		--	--			374 VA	0 VA			1	20 A		SPARE	16
17	Motor - FCU - LOUNGE 4236		20 A	2					94 VA	0 VA	1	20 A		SPARE	18
19	--		--	--	94 VA	0 VA					1	20 A		SPARE	20
21	Motor - UH - STAIR 6		20 A	1			192 VA	0 VA			1	20 A		SPARE	22
23	Motor - SD FLOOR 4C		20 A	1					550 VA	0 VA	1	20 A		SPARE	24
25	Motor - SD FLOOR 4C		20 A	1	400 VA	0 VA					1	20 A		SPARE	26
27	Motor - SD FLOOR 5C		20 A	1			400 VA	0 VA			1	20 A		SPARE	28
29	Motor - FSD FLOOR 4C		20 A	1					250 VA	0 VA	1	20 A		SPARE	30
31	Motor - FSD FLOOR 5C		20 A	1	200 VA	0 VA					1	20 A		SPARE	32
33	Motor - NGS 2 - FLOOR 5C		20 A	2			541 VA	0 VA			1	20 A		SPARE	34
35	--		--	--					541 VA	0 VA	1	20 A		SPARE	36
37	Motor - SD FLOOR 5C		20 A	1	900 VA	0 VA					1	20 A		SPARE	38
39	SPARE		20 A	1			0 VA	0 VA			1	20 A		SPARE	40
41	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		2592 VA		2662 VA		2214 VA						
			TOTAL AMPS:		22 A		23 A		18 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Motor	7468 VA	103.62%	7738 VA		
				TOTAL CONN. LOAD:	7468 VA
				TOTAL EST. DEMAND:	7738 VA
				TOTAL CONN.:	21 A
				TOTAL EST. DEMAND:	21 A

NOTES:

PANEL: LEP-OS-606

LOCATION: | **VOLTS:** 120/208 Wye | **INCIDENT ENERGY:** 0.14 cal/cm^2
SUPPLY FROM: LEDP-OS-103 | **PHASE:** 3 | **A.I.C. RATING:** 22kAIC
MOUNTING: SURFACE | **WIRE:** 4 | **BUS RATING:** 100 A
ENCLOSURE: TYPE 1 | **MAIN CB:** 100 A
CALCULATED FAULT CURRENT: 2697 AIC

CKT	CIRCUIT DESCRIPTION	TYPE	TRIP	POLES	A		B		C		POLES	TRIP	TYPE	CIRCUIT DESCRIPTION	CKT
1	Motor - FCU FLOOR 6 - BEDROOMS		20 A	2	250 VA	0 VA					1	20 A		SPARE	2
3	--		--	--			250 VA	0 VA			1	20 A		SPARE	4
5	Motor - FCU - LOUNGE 6277		20 A	2					94 VA	0 VA	1	20 A		SPARE	6
7	--		--	--	94 VA	0 VA					1	20 A		SPARE	8
9	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2			374 VA	0 VA			1	20 A		SPARE	10
11	--		--	--					374 VA	0 VA	1	20 A		SPARE	12
13	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2	281 VA	0 VA					1	20 A		SPARE	14
15	--		--	--			281 VA	0 VA			1	20 A		SPARE	16
17	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2					281 VA	0 VA	1	20 A		SPARE	18
19	--		--	--	281 VA	0 VA					1	20 A		SPARE	20
21	Motor - FCU FLOOR 5 - BEDROOMS		20 A	2			437 VA	0 VA			1	20 A		SPARE	22
23	--		--	--					437 VA	0 VA	1	20 A		SPARE	24
25	Motor - FCU - LOUNGE 5277		20 A	2	187 VA	0 VA					1	20 A		SPARE	26
27	--		--	--			187 VA	0 VA			1	20 A		SPARE	28
29	Equipment - DOOR HOLD OPEN 5D		20 A	1					1000 VA	0 VA	1	20 A		SPARE	30
31	Equipment - DOOR HOLD OPEN 6D		20 A	1	1000 VA	0 VA					1	20 A		SPARE	32
33	Motor - SD FLOOR 6D		20 A	1			600 VA	0 VA			1	20 A		SPARE	34
35	Motor - FSD FLOOR 5D		20 A	1					300 VA	0 VA	1	20 A		SPARE	36
37	Motor JAN. 6271		20 A	2	541 VA	0 VA					1	20 A		SPARE	38
39	--		--	--			541 VA	0 VA			1	20 A		SPARE	40
41	SPARE		20 A	1					0 VA	0 VA	1	20 A		SPARE	42
			TOTAL LOAD:		2633 VA		2670 VA		2486 VA						
			TOTAL AMPS:		22 A		22 A		21 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
Equipment	2000 VA	100.00%	2000 VA		
Motor	5788 VA	104.67%	6058 VA	**TOTAL CONN. LOAD:**	7788 VA
				TOTAL EST. DEMAND:	8058 VA
				TOTAL CONN.:	22 A
				TOTAL EST. DEMAND:	22 A

NOTES:

BALCH HALL RENOVATION

Cornell University

600 Thurston Ave
Ithaca, New York 14853

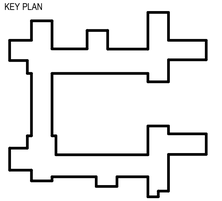
GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION
420 Boylston Street Boston, Massachusetts 02116-3866
p: 617.262.2760 f: 617.262.9512
www.goodyclancy.com

CONSULTANT

ARUP
Ove Arup & Partners PC
77 Water Street, New York NY 10005 USA
212.896.3000
www.arup.com

STAMP

KEY PLAN



100% Construction Documents

ISSUED: 11/05/2021

REVISIONS

3	BULLETIN #3	8/5/2022

ELECTRICAL PANEL SCHEDULES SHEET 13

FILE NAME:

DRAWN:	JP	DATE: 11/05/2021
CHECKED:	JT	SCALE: NTS

DRAWING NO.:

E9.13