# MANLY MILES
# AIR COOLED CHILLER

**PROJECT NUMBER:** CP22055

**ISSUED FOR:** 100% DESIGN REVIEW

**ISSUED DATE:** 04/28/2025

## PROJECT DIRECTORY


MSU SUPERVISOR: SALEM MANGLES
PHONE:
EMAIL: mangless@msu.edu

DESIGN PROFESSIONAL CONTACT: LENTZ BECRAFT
PHONE: (269) 207-9247
EMAIL: lbecraft@ignyte.design


## APPLICABLE CODES

- MICHIGAN STATE UNIVERSITY CAMPUS STANDARDS
- MICHIGAN BUILDING CODE (MBC) - 2015
- MICHIGAN MECHANICAL CODE (IMC) - 2021
- MICHIGAN PLUMBING CODE (IPC) - 2021
- MICHIGAN ELECTRICAL CODE (NFPA 70) - 2023
- MICHIGAN ENERGY CODE (IECC) - 2015
- MICHIGAN FIRE SPRINKLER CODE (NFPA 13) - 2013

## PROJECT SCOPE

THE SCOPE OF THIS PROJECT IS TO:

- REMOVE EXISTING WATER COOLED CHILLER AND ASSOCIATED PIPING AND EQUIPMENT.
- SIZE REPLACEMENT AIR-COOLED CHILLER SYSTEM, COMPLETE WITH NEW PLATE AND FRAME HEAT EXCHANGER, GLYCOL SKIDS, AND NECESSARY EQUIPMENT, CONTROLS, PUMPS, PIPING ETC.
- ALL ASSOCIATED ELECTRICAL POWER REQUIREMENTS AND CONDUIT ROUTING FOR EXTERIOR MOUNTED EQUIPMENT.
- INTERIOR TO EXTERIOR BUILDING PENETRATION TRANSITION DETAILS THROUGH THE EXISTING BUILDING WINDOW, LOCATED ON THE SOUTHEAST CORNER OF THE BUILDING.

## DRAWING INDEX




N

## PROJECT LOCATION

Infrastructure Planning and Facilities
MICHIGAN STATE UNIVERSITY

MANLY MILES
AIR COOLED CHILLER

MSU PROJ. NO.
24.214

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | |
| ISSUED | |
| Project Status | |

COVER SHEET

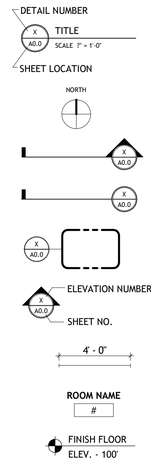
G000

# OF #

## ABBREVIATIONS

| | |
|---|---|
| A.F.F. | ABOVE FINISHED FLOOR |
| B.F. | BARRIER FREE |
| FT | FEET, FOOT |
| IN | INCH(ES) |
| LB | POUND(S) |
| LF | LINEAR FOOT, LINEAR FEET |
| @ | AT |
| A/C | AIR CONDITION, AIR CONDITIONER |
| ALUM | ALUMINUM |
| ACT | ACOUSTICAL CEILING |
| BD | BOARD |
| BLDG | BUILDING |
| BLKG | BLOCKING |
| BOTT | BOTTOM |
| BRG | BEARING |
| C TO C | CENTER TO CENTER |
| CAB | CABINET |
| CIR | CIRCLE |
| C.J. | CONSTRUCTION JOINT |
| C.L. | CENTER LINE |
| CLG | CEILING |
| CLO | CLOSET |
| CLR | CLEAR |
| CMU | CONCRETE MASONRY UNIT |
| COL | COLUMN |
| CONC | CONCRETE |
| CONST | CONSTRUCTION |
| CONT | CONTINUOUS |
| CORR | CORRIDOR |
| CTR | CENTER |
| DEMO | DEMOLITION, DEMOLISH |
| DET | DETAIL |
| DF | DRINKING FOUNTAIN |
| DIA | DIAMETER |
| DIM | DIMENSION |
| DN | DOWN |
| DS | DOWNSPOUT |
| EJ | EXPANSION JOINT |
| ELEC | ELECTRICAL |
| ELEV | ELEVATION |
| EQ | EQUAL |
| ETF | ELEVATION TOP OF FOOTING |
| ETS | ELEVATION TOP OF SLAB |
| ETW | ELEVATION TOP OF WALL |
| EXP | EXPOSED |
| EXST | EXISTING |
| EXT | EXTERIOR |
| EWC | ELECTRIC WATER COOLER |
| FD | FLOOR DRAIN |
| FE | FIRE EXTINGUISHER |
| FEC | FIRE EXTINGUISHER CABINET |
| FLR | FLOOR |
| FTG | FOOTING |
| GALV | GALVANIZED |
| GB | GRAB BARS |
| GYP. BD. | GYPSUM BOARD |
| HM | HOLLOW METAL |
| HORIZ | HORIZONTAL |
| HT | HEIGHT |
| ID | INSIDE DIAMETER |
| INSUL | INSULATION |
| JAN | JANITOR'S CLOSET |
| L.L. | LIVE LOAD |
| MAX | MAXIMUM |
| MECH | MECHANICAL |
| MANUF | MANUFACTURER |
| MIN | MINIMUM |
| MTL | METAL |
| NIC | NOT IN CONTRACT |
| NTS | NOT TO SCALE |
| OC | ON CENTER |
| PREFAB | PREFABRICATED |
| PSF | POUNDS PER SQUARE FOOT |
| PVC | POLYVINYL CHLORIDE |
| R | RADIUS |
| RD | ROOF DRAIN |
| REINF | REINFORCE |
| REQ'D | REQUIRED |
| REV | REVISION |
| RM | ROOM |
| SAN | SANITARY |
| SHWR | SHOWER |
| SIM | SIMILAR |
| SPEC | SPECIFICATION |
| SS | STAINLESS STEEL |
| STD | STANDARD |
| STOR | STORAGE |
| STRUC | STRUCTURAL |
| T.O.F. | TOP OF FOOTING |
| T.O.W. | TOP OF WALL |
| TYP | TYPICAL |
| UN | UNFINISHED |
| URIN | URINAL |
| VB | VAPOR BARRIER |
| VERT | VERTICAL |
| VEST | VESTIBULE |
| W/ | WITH |
| WD | WOOD |
| WIN | WINDOW |
| W/O | WITHOUT |
| WT | WEIGHT |
| W.W.F. | WELDED WIRE FABRIC |

## ARCHITECTURAL SYMBOLS AND PLAN INDICATORS




TYPICAL TITLE FOR SECTIONS & DETAILS

NORTH ARROW

BUILDING SECTION CUT

WALL SECTION CUT

ENLARGED PLAN OR SECTION INDICATOR

INTERIOR ELEVATION INDICATOR

TYPICAL DIMENSIONING

ROOM NAME/ ROOM NUMBER

ELEVATION INDICATION

DOOR TAG W/ DOOR NUMBER

WINDOW TAG W/ WINDOW TYPE

WALL TYPES

KEYNOTE TAG

COLUMN LINE

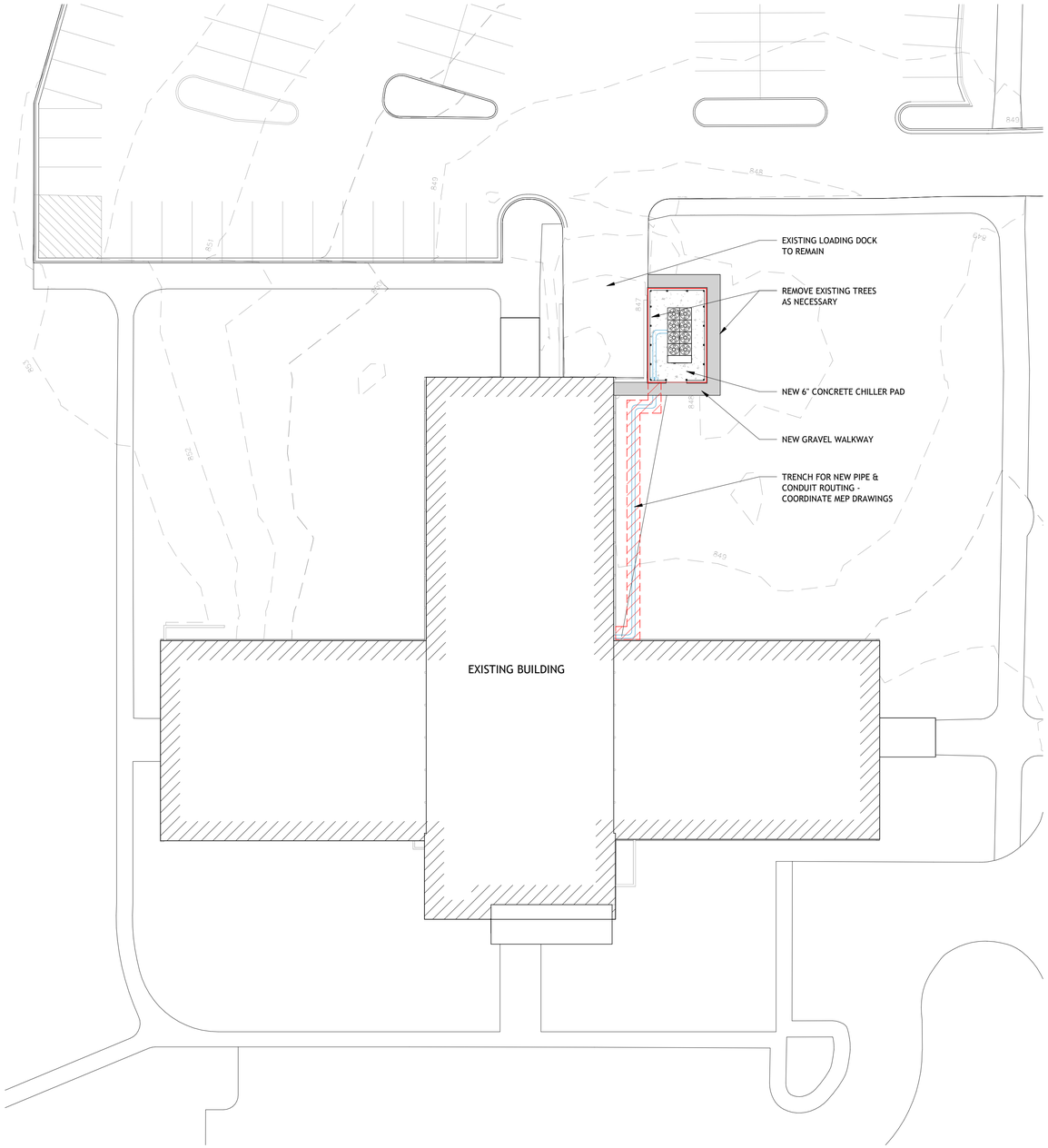
REVISION TAG W/ REVISION NUMBER

60" DIAMETER CLEAR WHEELCHAIR TURNING SPACE - REFER TO PLAN

30" x 48" CLEAR FLOOR AND GROUND SPACE - REFER TO PLAN

EXISTING DOOR AND FRAME

NEW DOOR AND FRAME




**SITE PLAN**
1" = 20'-0"

MICHIGAN STATE UNIVERSITY
Infrastructure Planning and Facilities

# MANLY MILES
## AIR COOLED CHILLER

MSU PROJ. NO.
00000

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Type | |

SITE PLAN

C100

# OF #

# SECTION 321313 – CONCRETE PAVEMENT

**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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes concrete pavement.

C. Related sections include:

1. Division 01 Section 014000-QUALITY REQUIREMENTS
2. Division 31 Section 312300-EARTHWORK
3. Division 33 Section 334000-STORM DRAINAGE

1.3 SUBMITTALS

A. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Provide required testing and inspection as indicated in Division 01 Section "General Requirements - Quality Requirements."

B. Concrete sampling, testing, and inspection shall conform to the following requirements:

1. Sampling Fresh Concrete: ASTM C172, except initial Samples shall be taken immediately after first 1/4 cubic yard (CY) has been discharged and subsequent Samples shall be taken as specified herein. If found to be in non-conformance, the concrete shall be removed from the forms.
2. Slump: ASTM C143, except initial Sample shall be taken in accordance with paragraph above. Additional tests shall be made for each set of compressive strength test specimens, and as required by the Project Representative.
3. Air Content: ASTM C231, except as previously specified herein and additional tests at the end of the load, if possible.
4. Concrete Temperature: Taken each time compression test specimens are made and hourly when temperature is 40 degrees F and below and over 80 degrees F.
5. Unit Weight: ASTM C138, except the Sample volume shall be equal to air content specimen.
6. Compressive Strength: ASTM C31 and C39, except one set of 3 cylinders for every 40 cy or fraction thereof. One specimen shall be tested at 7 days and the remaining 2 specimens shall be tested at 28 days. Strength level of the concrete will be considered unsatisfactory if the 7 day compressive strength does not equal or exceed 60% of the 28 day design strength. Strength level of concrete will be considered satisfactory if the average compressive strength of two consecutive 28 day tests equals or exceeds the 28 day design strength, and neither individual strength test results falls below the specified compressive strength requirement by more than 100 psi.
7. Inspection: Monitored by the Project Representative.
8. Frequency: In accordance with Division 01 Section "General Requirements - Quality Requirements."
9. Concrete Replacement: Failure of a test or to follow proper installation procedures will require that the concrete be removed and properly replaced at Contractor's expense.
10. Additional Tests: Contractor may have the testing agency make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42. Contractor shall pay for all such tests conducted. Holes shall be patched at the Contractor's expense.

1.5 SEQUENCING AND SCHEDULING

A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

1.6 WARRANTY

A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

**PART 2 - PRODUCTS**

2.1 CEMENT

A. Portland cement conforming to the requirements of the current specifications for Portland Cement ASTM C150 Type 1.

2.2 AIR-ENTRAINING ADMIXTURE

A. Conform to ASTM C260 for concrete.

2.3 FINE AGGREGATE

A. Limestone or other fine aggregate that is free of soft particles or other material that could cause staining or pitting of the pavement surface. For gradation purposes only, the material shall conform to MDOT Specification 2NS.

2.4 COARSE AGGREGATE

A. Well-graded limestone. Gradation and physical requirements to conform to MDOT Specification 6AA.

2.5 WATER

A. Potable.

2.6 REINFORCEMENT

A. Welded Wire Reinforcement:

1. Standard; Welded wire fabric (6 x 6 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
2. Heavy duty and heated pavement; Welded wire fabric (4 x 4 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.

B. Bar Reinforcement: No. 3, No. 4 and No. 5 bar reinforcement as specified on the Drawings. It shall be new billet stock of intermediate grade in accordance with ASTM A615.

2.7 DOWELS

A. Construction Expansion Joints:

1. No. 5 speed dowel 9 inches long, as manufactured by Greenstreak, Inc., 3400 Tree Court Industrial Blvd., St Louis, MO; 800-325-9504; or approved equal.
2. Dowel: 18 inches long, No. 5 smooth epoxy-coated rebar (coated all surfaces); or approved equal.
3. 1/4" x 4-1/2" x 4-1/2" electroplated zinc steel, ASTM A36, ASTM B633 with pocket formers
   a. Diamond Dowel System as manufactured by PNA Construction Technologies www.PNA-INC.com ; 800-542-0214 ; or approved equal.

B. Construction Joints:

1. As specified above.

2.8 FORMED KEYWAY

A. Standard keyway, 1-5/8-inch x 1-3/4-inch x 2-3/4-inch, as manufactured by Dee Concrete Accessories Company, P.O. Box 11119, Chicago, IL 60611; or approved equal.

2.9 ASPHALT EXPANSION JOINTS

A. Conform with ASTM Specification D994-53. Fiber joint material is not acceptable.

2.10 JOINT SEALER

A. Tremco Spectrem 800. Primer: Tremco Silicone Primer No. 23. Tremco-Sealant/Weatherproofing Division, 3735 Green Road, Beachwood, OH 44122; 800 321 7906.

2.11 CURING AND ANTI-SPALLING COMPOUNDS

A. Curing and Anti-Spalling Compound:

1. For use when the concrete is placed at 40 degrees F and above.
2. Sealtight brand Lin-Seal Emulsion curing and sealing compound; Clear emulsion product (not to be confused with Lin-Seal or Lin-Seal white).
3. Manufactured by M.G. by W.R. Meadows, Inc, PO Box 338, Hampshire, IL 60140 0338; 847-683-4500, 800-342-5976.

B. Waterproofing Compound:

1. For use when the concrete is placed below 40 degrees F or when the concrete pavement is within 50 feet of building entrances; or both. Either of the following will be accepted.
2. Products:
   a. Lifetime™ Water Sealant by Coatings International, Inc., 112 North Monroe, N.E. Rockford, MI 49341; 616-863-6529; Fax: 616-863-1076; www.coatingsinternational.com
   b. Consolideck Saltguard WB by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046; 785-865-4200; Fax: 785-830-9016; HYPERLINK "http://www.prosoco.com"www.prosoco.com.

C. Evaporation Retardant:

1. Conspec Aquafilm by Conspec Marketing & Manufacturing, 636 S. 66th Terrace, Kansas City, Kansas 66111; 800-348-7351
2. Confilm Evaporation Reducer by BASF Construction Chemicals, LLC, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544, 800-628-9990; Fax 216-839-8821
3. Approved equal

2.12 ADMIXTURES

A. As approved by Project Representative.

2.13 FORMWORK

A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the Work. Expansion joint materials shall not be used.

2.14 CONCRETE QUALITY

A. The mixture shall contain 6 sack Portland cement concrete, coarse aggregate, fine aggregate admixtures and water. The concrete mix design shall have a minimum 4000 psi compressive strength at 28 days. The maximum allowable slump shall be 4.5 inches. Aggregates shall be batched by weight. Air content shall be 5% to 8%. Maintain a maximum water/cement ratio of 0.46 pounds of water per pound of cement.

B. Contractor shall provide the Project Representative with delivery tickets which shall list slump, sack mix, percent of air entraining agent, time the truck left the plant, arrived on the site and departed the site, and water added at the site.

C. When requested, Contractor shall provide documentation from the concrete supplier certifying that the concrete meets the specifications of this section.

D. Color shall be limestone. Consistency of the color shall be uniform throughout the Project.

2.15 DETECTABLE WARNING PLATES

A. 24" x 24" Duralast Detectable Warnings, Product number 00700571, Natural Finish by East Jordan Iron Works, Inc.; 800-626-4653

**PART 3 - EXECUTION**

3.1 PLACING FORMS

A. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.

B. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.

C. Forms shall be cleaned and oiled each time they are used.

D. Forms shall be reviewed by the Project Representative prior to pouring.

3.2 PLACING REINFORCEMENT

A. Place reinforcement mesh as indicated on the Drawings and in the following areas:

1. Where the pavement crosses a recently filled trench and extending a minimum of 5 feet beyond the trench wall.
2. Where fill soil of 18 inches or more occurs.
3. As directed by the Project Representative.

B. Concrete shall be placed in 2 layers when mesh reinforcing is used. Use of brick, stones, etc., or unusual raising with bars or tools is prohibited. Proper positioning of the mesh can be achieved by either; (1) the use of metal or plastic chairs specifically intended for holding mesh reinforcement in the soil conditions present at the required depth, or (2) placing and consolidating a layer of concrete at the specified elevation of the reinforcement prior to placing reinforcement and a top layer of concrete

3.3 PLACING CONCRETE

A. Placing 6-inch (or greater, if specified) concrete shall not commence until the subbase and forms have been approved. Subbase shall be moistened in advance of concreting, but shall not be muddy or excessively wet. A sufficient quantity of forms shall be placed to accommodate the concrete that is scheduled to be poured at any one time. Concrete shall be deposited with a minimum of re-handling and shall be spaded adjacent to forms and joints. In the case of isolation joints, concrete shall be placed simultaneously against both sides of the joint.

B. Concreting shall not be continued when the air temperature is below 45 degrees F, unless the aggregates or water, or both, are heated to produce a placing temperature of the concrete between 60 degrees F and 90 degrees F., and unless adequate provisions are made for maintaining protection against freezing of the concrete for at least 7 days after placing. No concrete shall be placed on frozen subbase.

C. Should placement of concrete be necessary over or near tree roots, a thin layer of sulfur shall be placed on the area of the subbase which may be affected by the roots. Owner shall place sulfur. Provide 2 day notice to coordinate work with Owner's crews.

3.4 JOINTING

A. As indicated on the Drawings, as directed in the field by the Project Representative and in the following situations, unless otherwise specified:

1. Control (contraction) joints shall ordinarily be placed at intervals equal to the width of the slab or 8 feet, whichever is less. They shall be 1/8-inch to 3/16-inch wide and 1-1/4 inch deep, or 1/4 the thickness of the slab, whichever is greater. Where slabs exceed 8 feet in width, a straight longitudinal control joint shall be placed along the centerline of the slab. This joint shall begin and end only at isolation or construction joints.
2. Expansion joints shall be placed as indicated on the Drawings and if not conflicting with Drawings at intervals of at least every 40 lineal feet (LF), adjacent to footings and foundations, adjacent to curbs when required, adjacent to existing concrete where new concrete is to abut or at next available joint that is parallel to the edge of the existing concrete. Continue joints in adjoining concrete, in the same location as existed in the concrete that was removed, and where 2 or more walks intersect. Joints shall be placed in a vertical position through the entire slab thickness.
3. Construction joints (with dowels) shall be installed when placing operations are delayed more than a 1/2-hour at locations where normal control joints would occur, as indicated on the Drawings and as directed by the Project Representative.

B. Joints shall be tooled to the specified depth. If the pavement thickness is greater than 6 inches, sawing will be permitted after the joints have first been tooled. The only exception to this requirement is for basketball courts, where only saw cutting is permitted.

C. Joints shall be perpendicular to the edge and tangents and normal to curves. The joints shall not vary from the true line more than 1/4-inch.

D. When new walkways are adjacent to new curb and gutter or when required by the Project Representative, the Contractor shall install a Diamond Dowel System.

E. Place sealant in non-heated pavement joints when specified, according to manufacturer's recommendations, using primer as specified.

3.5 FINISHING

A. Concrete shall be placed and struck off with a straight board until voids are removed in the surface at the required grade and cross section.

B. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.

C. Immediately after the concrete has been struck off, the surface shall be floated with a magnesium bull float, just enough to produce a smooth surface free from irregularities. Edges shall be rounded to a radius of 1/4-inch with an approved edging tool. Jointing shall then commence immediately after edging and before the large aggregate in the concrete has started to settle.

D. The entire surface shall then be steel-troweled so that the large aggregate is set and the surface is free of edging joints and trowel marks.

E. The surface shall be heavy-broomed, keeping mortar out of joints. Brooming direction shall generally be perpendicular to the normal path of travel, unless otherwise directed by the Project Representative. Provide 2-inch retool at joints, if detailed on the Drawings.

F. Surface variations greater than 1/8-inch in 10 feet are unacceptable.

G. Walks shall be protected from pedestrian traffic for 2 days and vehicles for 7 days.

H. Concrete shall be stamped at each end of the work with the Contractor's name and the current year.

3.6 CURING AND ANTI-SPALLING COMPOUND APPLICATION

A. For temperatures above 40 degrees F, concrete shall be cured utilizing the specified curing/anti-spalling compound in accordance with product specifications using only a motorized sprayer. This application includes the sides of the concrete, once the forms have been removed.

B. For temperatures between 32 degrees F and 40 degrees F and on concrete within 50 feet of building entrances, cure pavement using an approved wet cure method for a period of not less than 7 full days while maintaining a concrete temperature above 34 degrees F for 14 days. After 30 days, the specified water proofing compound shall be applied according to product specifications.

3.7 DETECTABLE WARNING PLATES

1. Follow manufacturer's installation specifications to properly install detectable warning plates per site plan layout. Pay special attention to be sure the plastic concrete comes through all the holes in the plate to eliminate all cavities below the plate that could trap water.

## CONCRETE PAVEMENT WARRANTY

**PROJECT:**
**CONTRACTOR:**
**OWNER: BOARD OF TRUSTEES**
**MICHIGAN STATE UNIVERSITY**

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1st of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

a. Place in satisfactory condition all of such warranted Work,
b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: _____ DATE: _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____ _____

_____ (Print)

(Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS_____DAY OF_____

A.D._____

NAME

MY COMMISSION EXPIRES

END OF SECTION 321313

# SECTION 095113 - ACOUSTIC PANEL CEILINGS

**PART 1 - GENERAL**

1.1 M.S.U. ISSUES

1. It the intent of MSU that all joint sealants used on its projects will comply with LEED™ NC 3 Credit Requirements EQ Credit 4.1: Low-Emitting Materials: Adhesives and Sealants.
2. If a project involves removal of ceiling panels in sufficient quantity for recycling under the programs by USG and Armstrong, tiles will be stacked on pallets and stored in a dry location until they are picked up for recycling by a panel manufacturer.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Sections include the following:

1. Division 07 Section JOINT SEALANTS.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated and including VOC Statements for Sealants and Adhesives.

B. Maintenance Data: For finishes to include in maintenance manuals.

C. Certificate of Accreditation: Provide certificate as described in this section.

D. Scope of Accreditation: Provide scope as described in this section.

1.4 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panels with surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

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

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 CAST OR MOLDED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Manufacturers:

1. Armstrong World Industries, Inc.
2. BPB Celotex Corporation; Architectural Ceilings Marketing Dept.
3. National Gypsum
4. USG Interiors. Inc.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 4, cast or molded.

C. Color: White

D. Edge Detail: Reveal sized to fit flange of exposed suspension system member.

E. Thickness: ¾ inch.

F. Size: 24 by 24 inches.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Joint Sealants: See 07 Section JOINT SEALANTS.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING:

A. Available Manufacturers:

1. Armstrong World Industries, Inc.
2. BPB Celotex Corporation; Architectural Ceilings Marketing Dept.
3. Chicago metallic Corporation
4. USG Interiors, Inc.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Available Manufacturers:

1. Armstrong World Industries, Inc.
2. BPB Celotex Corporation; Architectural Ceilings Marketing Dept.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.
6. MM Systems, Inc.
7. USG Interiors, Inc.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

Infrastructure Planning and Facilities

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ARCHITECTURAL SPECIFICATIONS

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**PART 3 - EXECUTION**

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to long axis of space.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

# SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

**PART 1 - GENERAL**

1.1 M.S.U. ISSUES

A. M.S.U. uses steel doors and frames for openings subject to repeated impact or abuse, or when appropriate to achieve required fire resistance rating

B. When used on exterior openings, steel doors and frames shall be galvanized.

1.2 SUMMARY

A. This Section includes the following:

1. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Sections include the following:

1. Division 07 Section JOINT SEALANTS for sealants used in hollow metal frame installation.
2. Division 08 Section GLAZING for glazed lites in standard steel doors.
3. Division 08 Section HARDWARE for door hardware for standard steel doors.
4. Division 09 Section INTERIOR PAINTING for field painting standard steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire resistance rating and finishes for each type of steel door and frame specified.

B. Qualification Data: For Installer.

C. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

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. Amweld Building Products, LLC.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. CURRIES Company; an ASSA ABLOY Group Company.
4. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
5. Pioneer Industries, Inc.
6. Republic Doors and Frames; a Windsor Republic Door Company
7. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.

G. Grout: Comply with ASTM C 476, with a slump of 4 inches for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

H. Glazing: Comply with requirements in Division 8 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
   a. Fire Door Core: As required to provide fire-protection ratings indicated.
3. Vertical Edges for Single-Acting Doors: Beveled edge.
   a. Beveled Edge: 1/8 inch in 2 inches.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2-Seamless for standard size doors not subject to heavy abuse.
2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2-(Seamless) for large doors (greater than 48") or doors subject to heavy abuse.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch thick.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners.
2. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
3. Frames for Level 3 Steel Doors: 0.067-inch- thick steel sheet.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inches thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch thick.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

E. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.6 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
3. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete, masonry or plastered walls.
4. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1. Two anchors per jamb up to 60 inches in height.
      2. Three anchors per jamb from 60 to 90 inches in height.
      3. Four anchors per jamb from 90 to 120 inches in height.
      4. Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 inches in height.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1. Three anchors per jamb up to 60 inches in height.
      2. Four anchors per jamb from 60 to 90 inches in height.
      3. Five anchors per jamb from 90 to 96 inches in height.
      4. Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
      5. Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
   c. Compression Type: Not less than two anchors in each jamb.
   d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section DOOR HARDWARE.

1. Reinforce doors and frames to receive non-templated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.7 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

**1.** Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

**PART 3 - EXECUTION**

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Apply bituminous coating to backs of all exterior frames and those that are filled with mortar, grout, and plaster containing anti freezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

A. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

B. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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ARCHITECTURAL SPECIFICATIONS

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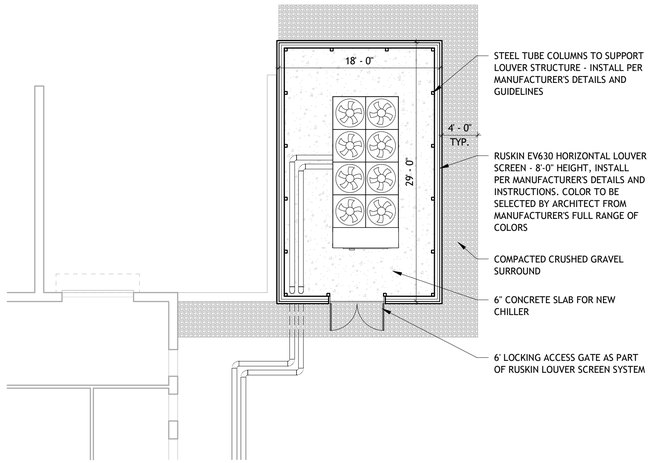
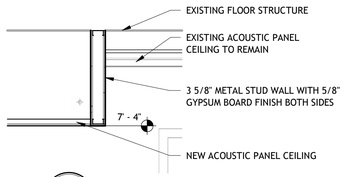
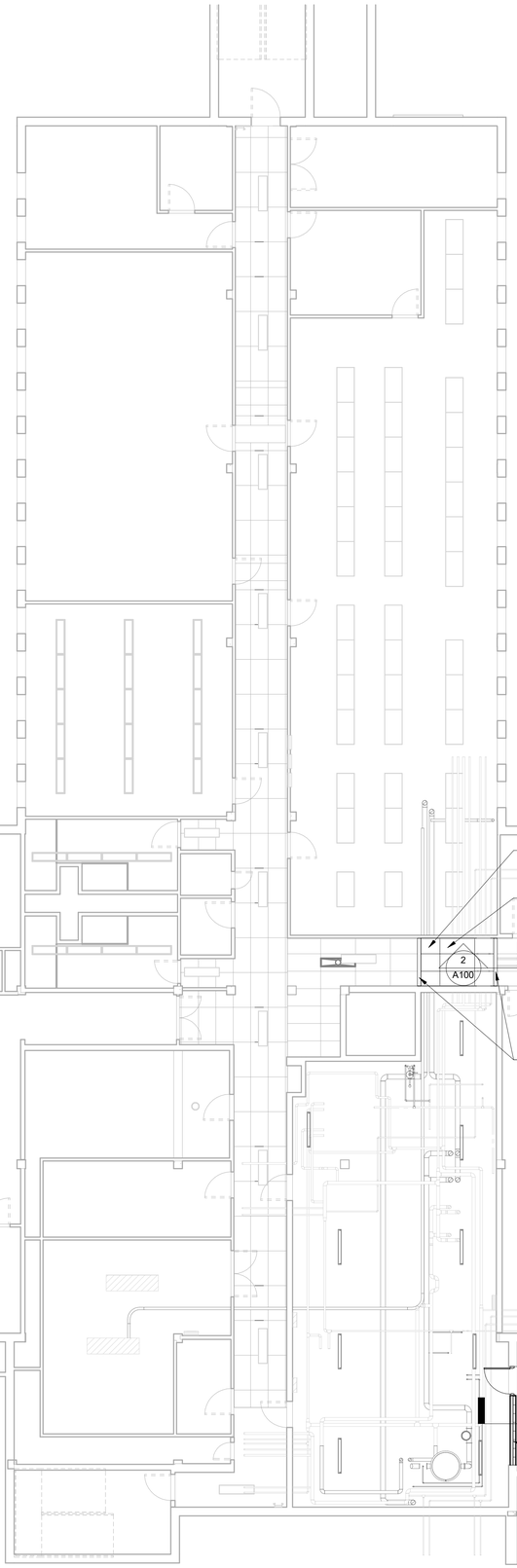


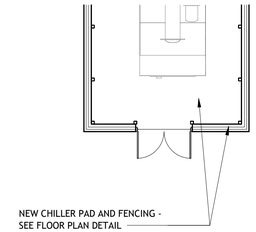

## CHILLER AREA FLOOR PLAN
1/8" = 1'-0"

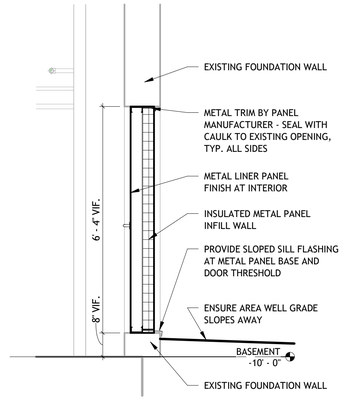



## 2 / A100 BULKHEAD SECTION
1/2" = 1'-0"

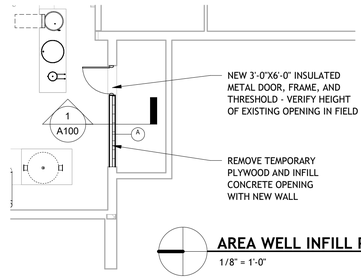



## BASEMENT REFLECTED CEILING PLAN
1/8" = 1'-0"




## 1 / A100 INFILL WALL SECTION
1/2" = 1'-0"




## AREA WELL INFILL PLAN
1/8" = 1'-0"

## WALL TYPE LEGEND

| VIEW ON PLAN DETAIL | DESCRIPTION |
|---|---|
|  | TYPICAL INFILL WALL<br>• 4" INSULATED METAL PANEL<br>• 3 5/8" METAL STUDS @ 16" O.C.<br>• METAL LINER PANEL |

## GENERAL ARCHITECTURAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF THE MICHIGAN BUILDING CODE AND ALL LOCAL AUTHORITIES HAVING JURISDICTION.
2. PROVIDE PORTABLE FIRE EXTINGUISHERS IN ACCORDANCE WITH THE 2000 ICC INTERNATIONAL FIRE CODE, MBC (906.1).
3. ACCESSIBLE CONTROLS, OPERATING MECHANISMS AND HARDWARE SHALL COMPLY WITH SECTIONS 1109.13 OF THE MBC AND SECTION 309 OF ICC/ANSI 117.1.
4. ALL NEW DOORS TO RECEIVE LEVER HANDLES AND CONFIGURATION TO COMPLY WITH SECTIONS 404.2.3 THROUGH 303.2.3.5 OF ANSI ICC A117.1 (2003) REQUIREMENTS.
5. FIRESEAL ALL PENETRATIONS, SUCH AS, PIPES, DUCTS, CONDUITS, ETC. THROUGH FIRE AND/OR SMOKE RATED ASSEMBLIES.
6. ALL EXISTING CONDITIONS SHOULD BE FIELD VERIFIED BEFORE WORK BEGINS.

MICHIGAN STATE UNIVERSITY
Infrastructure Planning and Facilities

# MANLY MILES
## AIR COOLED CHILLER

MSU PROJ. NO.
00000

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | --- |
| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Type | |

ARCHITECTURAL DRAWINGS

A100

# OF #

# MECHANICAL ABBREVIATION LIST

| ABBREVIATION | DESCRIPTION |
|---|---|
| AAV | AUTOMATIC AIR VENT |
| ACC | AIR COOLED CONDENSER |
| ACCU | AIR COOLED CONDENSER UNIT |
| AD | ACCESS DOOR |
| AFF | ABOVE FINISHED FLOOR |
| AFMS | AIRFLOW MEASURING STATION |
| AG | ABOVE GRADE |
| AHU | AIR HANDLING UNIT |
| ALT | ALTERNATE |
| AMP | AMPERE |
| APD | AIR PRESSURE DROP |
| ASHRAE | AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS |
| ASR | AUTOMATIC SPRINKLER RISER |
| AUX | AUXILIARY |
| BAS | BUILDING AUTOMATION SYSTEM |
| BCU | BLOWER COIL UNIT |
| BDD | BACK DRAFT DAMPER |
| BFF | BELOW FINISHED FLOOR |
| BFP | BACKFLOW PREVENTER |
| BHP | BRAKE HORSEPOWER |
| BOD | BOTTOM OF DUCT |
| BOP | BOTTOM OF PIPE |
| BTU | BRITISH THERMAL UNIT |
| BTUH | BRITISH THERMAL UNIT PER HOUR |
| C | COMMON |
| CAP | CAPACITY |
| CAV | CONSTANT AIR VOLUME |
| CB | CATCH BASIN |
| CC | COOLING COIL |
| CD | COLD DECK |
| CD | CONDENSATE DRAIN |
| CFCI | CONTRACTOR FURNISHED, CONTRACTOR INSTALLED |
| CFH | CUBIC FEET PER HOUR |
| CFM | CUBIC FEET PER MINUTE |
| CH | CHILLER |
| CHW | CHILLED WATER |
| CHWR | CHILLED WATER RETURN |
| CHWS | CHILLED WATER SUPPLY |
| CLG | COOLING |
| CNDS | CONDENSATE |
| CNDS (__#) | CONDENSATE (SPECIFIC PSIG) |
| CO | CLEAN OUT |
| CO2 | CARBON DIOXIDE |
| CONT | CONTINUATION OR CONTINUED |
| CONTR | CONTRACTOR |
| CONV | CONVECTOR |
| COP | COEFFICIENT OF PERFORMACE |
| CP | CIRCULATING PUMP |
| CRU | CONDENSATE RETURN UNIT |
| CSS | CLINICAL SERVICE SINK |
| CT | COOLING TOWER |
| CUH | CABINET UNIT HEATER |
| CW | DOMESTIC COLD WATER |
| CWF | DOMESTIC COLD WATER FILTERED |
| DA | DISCHARGE AIR |
| DAT | DISCHARGE AIR TEMPERATURE |
| DB | DRY BULB |
| DDC | DIRECT DIGITAL CONTROL |
| DEG | DEGREE |
| DFU | DRAINAGE FIXTURE UNITS |
| DIA | DIAMETER |
| DMPR | DAMPER |
| D/N | DAY/NIGHT |
| DN | DOWN |
| DNZ | DOWNSPOUT NOZZLE |
| DS | DUCT SILENCER |
| DT | DRAIN TILE |
| DTC | DRAIN TILE CONNECTION |
| DWH | DOMESTIC WATER HEATER |
| DWG | DRAWING |
| (E) | EXISTING |
| EXIST | EXISTING |
| EA | EXHAUST GRILLE OR REGISTER |
| EA | EACH |
| EA | EXHAUST AIR |
| EAT | ENTERING AIR TEMPERATURE |
| ECUH | ELECTRIC CABINET UNIT HEATER |
| EDB | ENTERING DRY BULB |
| EER | ENERGY EFFICIENCY RATIO |
| EEW/S | EMERGENCY EYE WASH / SHOWER |
| EEW | EMERGENCY EYE WASH |
| EF | EXHAUST FAN |
| EFF | EFFICIENCY |
| EHC | ELECTRIC HEATING COIL |
| EJ | EXPANSION JOINT |
| EL | ELEVATION |
| ELEC | ELECTRICAL |
| EMS | EMERGENCY SHOWER |
| ESP | EXTERNAL STATIC PRESSURE |
| EUH | ELECTRIC UNIT HEATER |
| EWB | ENTERING WET BULB |
| EWC | ELECTRIC WATER COOLER |
| EWT | ENTERING WATER TEMPERATURE |
| EXH | EXHAUST |
| FP | FIRE PROTECTION |
| °F | DEGREEES FAHRENHEIT |
| F&B | FACE AND BYPASS |
| F&T | FLOAT AND THERMOSTATIC |
| FA | FACE AREA |
| FCU | FAN COIL UNIT |
| FD | FLOOR DRAIN |
| FFD | FUNNEL FLOOR DRAIN |
| FH | FIRE HYDRANT |
| FHC | FIRE HOSE CABINET |
| FHR | FIRE HOSE RACK |
| FHV | FIRE HOSE VALVE |
| FLA | FULL LOAD AMPS |
| FLR | FLOOR |
| FM | FLOW METER |
| FMS | FLOW MEASURING STATION |
| FPM | FEET PER MINUTE |
| FP | FIRE PUMP |
| FS | FLOOR SINK |
| FSE | FOOD SERVICE EQUIPMENT |
| FT | FEET |
| FTR | FINNED TUBE RADIATION |
| FW | FOOT WASH |
| FV | FACE VELOCITY |
| G | NATURAL GAS |
| GA | GAUGE |
| GAL | GALLON |
| GH | GROUND HYDRANT |
| GRH | GRAVITY RELIEF HOOD |
| GPH | GALLONS PER HOUR |
| GPM | GALLONS PER MINUTE |
| H | HYDROGEN |
| HB | HOSE BIBB |
| HC | HEATING COIL |
| HD | HOT DECK |
| HEPA | HIGH EFFICIENCY PARTICULATE ARRESTANCE |
| HL | HIGH LIMIT |
| HOA | HAND/OFF/AUTO |
| HO | HUB OUTLET |
| HP | HEAT PUMP |
| HP | HORSEPOWER |
| HPL | HEAT PUMP LOOP |
| HR | HOUR |
| HTG | HEATING |
| HV | HEATING VENTILATING |
| HVAC | HEATING, VENTILATING, AIR CONDITIONING |
| HW | DOMESTIC HOT WATER |
| HW(__) | DOMESTIC HOT WATER (SPECIFIC TEMP °F) |
| HWR | DOMESTIC HOT WATER RETURN |
| HX | HEAT EXCHANGER |
| HZ | HERTZ |
| IAQ | INDOOR AIR QUALITY |
| ID | INSIDE DIAMETER |
| IE | INVERT ELEVATION |
| IH | INTAKE HOOD |
| IN | INCHES |
| IR | INFRARED HEATER |
| IW | INDIRECT WASTE |
| JC | JANITOR'S CLOSET |
| JP | JOCKEY PUMP |
| KW | KILOWATT |
| KWH | KILOWATT-HOUR |
| LAT | LEAVING AIR TEMPERATURE |
| LAB | LABRATORY |
| LAV | LAVATORY |
| LBS | POUNDS |
| LDB | LEAVING DRY BULB |
| LD | LINEAR DRAIN |
| LL | LOW LIMIT |
| LPC | LOW PRESSURE CONDENSATE |
| LPS | LOW PRESSURE STEAM |
| LPS(__#) | LOW PRESSURE STEAM (SPECIFIC PSIG) |
| LRA | LOCKED ROTOR AMPS |
| LWB | LEAVING WET BULB |
| LWT | LEAVING WATER TEMPERATURE |
| MA | MIXED AIR |
| MAT | MIXED AIR TEMPERATURE |
| MAU | MAKE-UP AIR UNIT |
| MAX | MAXIMUM |
| MBH | THOUSAND BRITISH THERMAL UNITS PER HOUR |
| MCA | MEDICAL COMPRESSED AIR |
| MCC | MINIMUM CIRCUIT AMPACITY |
| MECH | MOTOR CONTROL CENTER |
| MEZZ | MECHANICAL |
| MFR | MEZZANINE |
| MH | MANUFACTURER |
| MIN | MANHOLE |
| MISC | MINIMUM |
| MMBH | MISCELLANEOUS |
| M/S | MILLION BRITISH THERMAL UNITS PER HOUR |
| MTD | MOTOR STARTER |
| MTR | MOUNTED |
| MV | MOTOR |
| | MANUAL AIR VENT |
| NC | |
| NC | NOISE CRITERIA |
| NCTC | NORMALLY CLOSED |
| NCTO | NORMALLY CLOSED TIMED CLOSED |
| NFWH | NORMALLY CLOSED TIMED OPEN |
| NFPA | NON-FREEZE WALL HYDRANT |
| NOTC | NATIONAL FIRE PROTECTION AGENCY |
| NOTO | NORMALLY OPEN TIMED CLOSED |
| NIC | NORMALLY OPEN TIMED OPEN |
| NO | NOT IN CONTRACT |
| NOM | NORMALLY OPEN |
| NPCW | NOMINAL |
| | NON POTABLE COLD WATER |
| O | OXYGEN |
| OA | OUTSIDE AIR |
| OAT | OUTSIDE AIR TEMPERATURE |
| OBD | OPPOSED BLADE DAMPER |
| OC | ON CENTER/CENTER TO CENTER |
| OD | OUTSIDE DIAMETER |
| OED | OPEN ENDED DUCT |
| OFCI | OWNER FURNISHED, CONTRACTOR INSTALLED |
| OFOI | ONWER FURNISHED, OWNER INSTALLED |
| OL | OVERLOAD |
| ORC | OVERFLOW RAIN CONDUCTOR |
| ORD | OVERFLOW ROOF DRAIN |
| OS&Y | OUTSIDE SCREW AND YOKE |
| OV | OUTLET VELOCITY |
| OWS | OPERATOR WORKSTATION |
| PACU | PACKAGED AIR CONDITIONING UNIT |
| PBD | PARALLEL BLADE DAMPER |
| PC | PUMPED CONDENSATE |
| PD | PRESSURE DROP (FEET OF WATER) |
| PNL | PANEL |
| PPM | PARTS PER MILLION |
| PRESS | PRESSURE |
| PRV | PRESSURE REDUCING VALVE |
| PSAN | PUMPED SANITARY |
| PSI | POUNDS PER SQUARE INCH |
| PSIA | POUNDS PER SQUARE INCH - ABSOLUTE |
| PSIG | POUNDS PER SQUARE INCH - GAUGE |
| (R) | RELOCATED |
| R | RETURN GRILLE OR REGISTER |
| RA | RETURN AIR |
| RAT | RETURN AIR TEMPERATURE |
| RCP | RADIANT CEILING PANEL |
| RD | ROOF DRAIN |
| REQD | REQUIRED |
| REF | ROOF EXHAUST FAN |
| RF | RETURN FAN |
| RH | RELATIVE HUMIDITY |
| RL | REFRIGERANT LIQUID |
| RLFA | RELIEF AIR |
| RPM | REVOLUTIONS PER MINUTE |
| RS | REFRIGERANT SUCTION |
| RTU | ROOFTOP UNIT |
| SA | SUPPLY AIR DIFFUSER OR GRILLE |
| SA | SOUND ATTENUATOR |
| SA | SUPPLY AIR |
| SAN | SANITARY WASTE |
| SAN (GREASE) | SANITARY WASTE - GREASE |
| SAT | SUPPLY AIR TEMPERATURE |
| SECT | SECTION |
| SF | SUPPLY FAN |
| SH | SHOWER |
| SK | SINK |
| SMR | SNOW MELT RETURN |
| SMS | SNOW MELT SUPPLY |
| SP | STATIC PRESSURE |
| SPEC | SPECIFICATION |
| SPKLR | SPRINKLER |
| SQFT | SQUARE FOOT/SQUARE FEET |
| S/S | START/STOP |
| SS | SERVICE SINK |
| ST | STORM |
| STD | STANDARD |
| STK | STACK |
| ST | STORM |
| ST (OF) | STORM (OVERFLOW) |
| S/W | SUMMER/WINTER |
| SW | SWITCH |
| TA | TRANSFER AIR GRILLE |
| TC | TEMPERATURE CONTROL |
| TC | TEMPERING COIL |
| TCP | TEMPERATURE CONTROL PANEL |
| TD | TRENCH DRAIN |
| TEMP | TEMPERATURE |
| TEMP | TEMPORARY |
| TH | TERMINAL HEATING |
| THA | TOTAL HEAT ABSORBED |
| THR | TERMINAL HEATING RETURN |
| THR | TOTAL HEAT REJECTED |
| THS | TERMINAL HEATING SUPPLY |
| TSP | TOTAL STATIC PRESSURE |
| TU | TERMINAL UNIT |
| TV | TURNING VANES |
| TYP | TYPICAL |
| UH | UNIT HEATER |
| UL | UNDERWRITER'S LABORATORY |
| UNO | UNLESS NOTED OTHERWISE |
| UR | URINAL |
| UV | UNIT VENTILATOR |
| V | VALVE |
| V | VENT |
| VAC | VACUUM |
| VAV | VARIABLE AIR VOLUME |
| VB | VACUUM BREAKER |
| VD | VOLUME DAMPER (MANUALLY ADJUSTABLE) |
| VOL | VOLUME |
| VFC | VARIABLE FREQUENCY CONTROLER |
| VTR | VENT THROUGH ROOF |
| VTU | VENTURI TERMINAL UNIT |
| VUV | VERTICAL UNIT VENTILATOR |
| W | WASTE |
| W&V | WASTE AND VENT |
| WB | WET BULB |
| WC | WATER CLOSET |
| WC | WATER COLUMN |
| WG | WATER GAUGE |
| WPD | WATER PRESSURE DROP |
| WT | WEIGHT |
| XFMR | TRANSFORMER |

# MECHANICAL SYMBOL LIST

## PIPING SYMBOLS

| SYMBOL | DESCRIPTION |
|---|---|
| AV | AIR VENT - AUTOMATIC |
| MV | AIR VENT - MANUAL |
| BFP | BACKFLOW PREVENTER |
| | CATCH BASIN |
| | CIRCULATING PUMP |
| CO | CLEAN OUT - IN FLOOR |
| CO | CLEAN OUT - FLANGE |
| | DIRECTION OF FLOW |
| | DIRECTION OF PITCH - DOWN |
| | FINNED TUBE RADIATION |
| | FIRE PROTECTION - SIAMESE CONNECTION - FREE STANDING |
| | FIRE PROTECTION - SIAMESE CONNECTION - WALL MOUNTED |
| | FIRE PROTECTION - SPRINKLER HEAD, CONCEALED |
| | FIRE PROTECTION - SPRINKLER HEAD, PENDANT |
| | FIRE PROTECTION - SPRINKLER HEAD, UPRIGHT |
| | FIRE PROTECTION - SPRINKLER HEAD, SIDEWALL |
| | FLOOR DRAIN |
| | FLOOR DRAIN - ELEVATION |
| | FLOOR DRAIN - FUNNEL |
| | FLOOR DRAIN - FUNNEL, ELEVATION |
| | FLOW MEASURING DEVICE (FOR TEST AND BALANCING) |
| FS | FLOW SWITCH |
| FM | FLOW METER |
| HB | HOSE BIBB |
| MH | MANHOLE |
| | OPEN SITE DRAIN |
| | PIPE - ANCHOR |
| | PIPE - CAP OR PLUG |
| | PIPE - ELBOW DOWN |
| | PIPE - ELBOW UP |
| | PIPE - EXPANSION JOINT OR COMPENSATOR |
| | PIPE - FLANGE |
| | PIPE - HOSE AND BRAID FLEXIBLE CONNECTION |
| | PIPE - RUBBER FLEXIBLE CONNECTION |
| | PIPE - GUIDE |
| | PIPE - TEE DOWN |
| | PIPE - TEE UP |
| | PIPE - UNION |
| P/T | PRESSURE AND TEMPERATURE TEST PLUG |
| | PRESSURE GAUGE AND COCK |
| | REDUCER - CONCENTRIC |
| | REDUCER - ECCENTRIC |
| | ROOF/OVERFLOW DRAIN |
| | STEAM TRAP - FLOAT AND THERMOSTATIC |
| | STRAINER |
| | STRAINER WITH VALVE AND BLOW-OFF |
| | THERMOMETER |
| | TRAP |
| | VALVE - ANGLE |
| | VALVE - BALL |
| 0.5 | VALVE - BALANCE (i.e. BALANCE VALVE TO 0.5 GPM) |
| 0.5 | VALVE - COMINATION BALANCE & FLOW MEASURING (i.e. BALANCE VALVE TO 0.5 GPM) |
| | VALVE - BUTTERFLY |
| | VALVE - CHECK |
| | VALVE - SPRING CHECK |
| | VALVE - GAS (MANUAL) |
| | VALVE - GLOBE |
| | VALVE - ISOLATION |
| | VALVE - NEEDLE |
| | VALVE - OS&Y |
| | VALVE - PLUG |
| | VALVE - PRESSURE REGULATING |
| | VALVE - PRESSURE REDUCING |
| | VALVE - PRESSURE RELIEF |
| | VALVE - PRESSURE & TEMPERATURE RELIEF |
| VTR | VENT THROUGH ROOF |
| WH | WALL HYDRANT |

## DUCTWORK SYMBOLS

| SYMBOL | DESCRIPTION |
|---|---|
| TU-101 | AIR TERMINAL UNIT |
| TU-101 | AIR TERMINAL UNIT WITH HEATING COIL |
| | DAMPER - HORIZONTAL FIRE (EXISTING, NEW) |
| | DAMPER - HORIZONTAL FIRE / SMOKE (EXISTING, NEW) |
| | DAMPER - SMOKE (EXISTING, NEW) |
| | DAMPER - VERTICAL FIRE (EXISTING, NEW) |
| | DAMPER - VERTICAL FIRE / SMOKE (EXISTING, NEW) |
| BDD | DAMPER - BACK DRAFT |
| M | DAMPER - MOTORIZED |
| | DAMPER - VOLUME (MANUALLY ADJUSTABLE) |
| | DIFFUSER - BLANK OFF |
| | DIFFUSER - LINEAR SLOT |
| | DIFFUSER - SQUARE OR RECTANGULAR |
| | DUCT CROSS SECTION - SUPPLY |
| | DUCT CROSS SECTION - RETURN |
| | DUCT CROSS SECTION - EXHAUST |
| | DUCT - FLEXIBLE CONNECTION |
| | DUCT - FLEXIBLE DUCT |
| | DUCT TAKE-OFF - ROUND CONICAL |
| | DUCT TAKE-OFF - RECTANGULAR WITH SHOE TAP |
| | ELBOW - RECTANGULAR WITH TURNING VANES |
| | ELBOW - RECTANGULAR/ ROUND SMOOTH RADIUS |
| | ELBOW DOWN - RECTANGULAR |
| | ELBOW DOWN - ROUND |
| | ELBOW UP - RECTANGULAR |
| | ELBOW UP - ROUND |
| | HEATING COIL |
| D | INCLINED DROP IN DIRECTION OF AIRFLOW |
| R | INCLINED RISE IN DIRECTION OF AIRFLOW |
| | INTAKE OR RELIEF HOOD |
| | REGISTER - RETURN OR EXHAUST |
| | REGISTER - RETURN WITH BOOT |
| | REGISTER - TRANSFER GRILLE |
| | ROOF EXHAUST FAN |

## DOUBLE LINE DUCTWORK SYMBOLS

| SYMBOL | DESCRIPTION |
|---|---|
| | DUCT TAKE-OFF - RECTANGULAR WITH SHOE TAP |
| | DUCT TAKE-OFF - ROUND CONICAL |
| | ELBOW - RECTANGULAR WITH TURNING VANES |
| | ELBOW - RECTANGULAR SHORT RADIUS WITH SPLITTER VANES |
| | ELBOW - ROUND |
| | ELBOW - RECTANGULAR SMOOTH RADIUS |
| | ELBOW DOWN - RECTANGULAR |
| | ELBOW DOWN - ROUND |
| | ELBOW UP - RECTANGULAR |
| | ELBOW UP - ROUND |
| | HEATING COIL |
| D | INCLINED DROP IN DIRECTION OF AIRFLOW |
| R | INCLINED RISE IN DIRECTION OF AIRFLOW |
| | TRANSITION - CONCENTRIC |
| | TRANSITION -ECCENTRIC |

Infrastructure Planning and Facilities

MICHIGAN STATE UNIVERSITY

MANLY MILES
AIR COOLED CHILLER

MSU PROJ. NO.
24.214

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

MECHANICAL SYMBOLS AND GENERAL NOTES

M000

# OF #

# MECHANICAL SPECIFICATIONS

1. DRAWINGS ARE SCHEMATIC IN NATURE AND ARE INTENDED AS A GUIDE TO THE CONTRACTOR, BUT DO NOT NECESSARILY SHOW ALL DETAILS, OFFSETS, ETC. IT IS UNDERSTOOD AND AGREED BY THE INSTALLER THAT WORK HEREIN DESCRIBED SHALL BE COMPLETE IN EVERY DETAIL, EVEN THOUGH EVERY ITEM INVOLVED IS NOT PARTICULARLY MENTIONED. INSTALLER SHALL BE HELD TO PROVIDE ALL LABOR AND MATERIALS NECESSARY FOR THE WORK INTENDED AND DESCRIBED FOR A COMPLETE AND OPERATIONAL SYSTEM. SUCH MATERIALS SHALL INCLUDE PIPING, VALVES, TRAPS, GAUGES, CONTROLS, ETC. THIS ALSO INCLUDES EQUIPMENT REQUIRED BY STATE AND LOCAL CODES. CONTRACTOR SHALL REVIEW THE DOCUMENTS, AND ALL APPLICALBE CODES AND STANDARDS TO ENSURE THE FINAL INSTALLATION IS IN COMPILANCE WITH ALL. MAJOR CHANGES ARE NOT TO BE MADE WITH OUT FIRST CONSULTING WITH THE ENGINEER.

2. ALL WORK AND EQUIPMENT PROVIDED AND PERFORMED ON THIS PROJECT SHALL COMPLY WITH ALL APPLICABLE LAWS, CODES, ETC OF ANY AND ALL AUTHORITIES HAVING JURISDICTION INCLUDING, BUT NOT LIMITED TO: MICHIGAN MECHANICAL CODE - 2021, MICHIGAN PLUMBING CODE - 2021, MICHIGAN BUILDING CODE - 2015, MICHIGAN UNIFORM ENERGY CODE (ASHRAE 90.1-2013). THE LOCAL FIRE MARSHAL, UNDERWRITERS LABORATORIES, IRI, FM, NATIONAL ELECTRICAL CODE, LOCAL HEALTH DEPARTMENT, OSHA, MIOSHA. ANY MODIFICATIONS REQUIRED BY ANY OF THE ABOVE SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER. WHERE THE CONTRACT DOCUMENTS EXCEED THE CODE REQUIREMENTS, THE CONTRACT DOCUMENTS SHALL BE FOLLOWED. DEVIATIONS FROM THE CONTRACT DOCUMENTS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW BEFORE INSTALLATION.

3. THE BID SHALL INCLUDE ALL LABOR AND MATERIALS ESSENTIAL TO PROVIDE A COMPLETE AND FUNCTIONING SYSTEM AS DESCRIBED IN THE CONTRACT DOCUMENTS, EVEN THOUGH EVERY ITEM INVOLVED IS NOT PARTICULARLY MENTIONED. SUCH MATERIALS SHALL INCLUDE PIPING, VALVES, TRAPS, GAUGES, CONTROLS, ETC. THIS ALSO INCLUDES EQUIPMENT REQUIRED BY STATE AND LOCAL CODES. IN CASES OF DOUBT AS TO WORK INTENDED THE CONTRACTOR SHALL REQUEST SUPPLEMENTARY INFORMATION AT LEAST FIVE(5) DAYS PRIOR TO BIDDING. ONCE CONTRACT IS AWARDED ANY DISPUTES AS TO THE INTENT OF THE DESIGN SHALL BE RESOLVED AS DIRECTED BY THE ENGINEER AND NO ADDITIONAL COST TO THE OWNER.

4. CONTRACTOR IS RESPONSIBLE TO COORDINATE ALL EQUIPMENT AND MATERIALS WITH ALL OTHER TRADES.

5. A SET OF AS-BUILT DOCUMENTS SHALL BE KEPT ON THE JOB SITE, ACCESSIBLE TO ALL TRADES. CONTRACTOR SHALL MAINTAIN THE AS-BUILT DRAWINGS DAILY INDICATING ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS. CONTRACTOR SHALL MAINTAIN COMMUNICATION WITH ALL OTHER TRADES AND REVIEW AS-BUILT DOCUMENTS OF ALL TRADES ON A REGULAR BASIS. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH ALL TRADES DURING CONSTRUCTION AND FOR NOTIFYING THE ENGINEER OF ANY CHANGES THAT WILL NEED TO BE MADE AS SOON AS THEY ARE IDENTIFIED.

6. ALL PRODUCTS AND MATERIALS USED SHALL BE NEW AND "BEST OF ITS KIND." PRODUCTS AND MATERIALS SHALL BE PROTECTED FROM CONSTRUCTION AND WEATHER DAMAGE. CONTRACTOR SHALL NOT INSTALL ANY COMPONENT THAT IS DAMAGED, DIRTY, OR SHOWS ANY SIGNS OF CORROSION.

7. ALL WORK ON THIS PROJECT SHALL BE EXECUTED IN A GOOD, WORKMAN LIKE MANNER USING MECHANICS SKILLED IN THEIR RESPECTIVE TRADES. NO ALLOWANCE WILL BE GIVEN FOR POOR WORKMANSHIP. ANY INSTALLATION THAT IS OF INSUFFICIENT QUALITY SHALL BE REPLACED BY THE CONTRACTOR AT NO COST TO THE OWNER.

8. CONTRACTOR SHALL COORDINATE WITH THE OWNER ANY OWNER FURNISHED EQUIPMENT. CONTRACTOR SHALL RECEIVE ANY OWNER FURNISHED ITEMS WHEN DELIVERED TO THE JOB SITE AND SHALL BE RESPONSIBLE FOR THE ITEMS ONCE RECEIVED.

9. CONTRACTOR SHALL REVIEW ARCHITECTURAL DRAWINGS FOR LOCATIONS OF SLAB-TO-SLAB PARTITIONS, FIRE RATED PARTITIONS AND FIRE RATED FLOORS. ALL PENETRATION OF SLAB-TO-SLAB PARTITIONS SHALL BE SEALED AIR TIGHT. ALL PENETRATIONS OF FIRE RATED PARTITIONS OR FLOORS SHALL BE PROVIDED WITH A FIRE RATED DAMPER AND ACCESS DOOR. DAMPER SHALL HAVE A RATING APPROPRIATE FOR THE ASSEMBLY PENETRATED.

10. PENETRATIONS OF FIRE RATED ASSEMBLIES SHALL BE SEALED USING CODE APPROVED, LABORATORY TESTED AND LABELED SEALANTS FOR A FIRE RESISTANCE RATING EQUAL TO OR GREATER THAN THE ASSEMBLY PENETRATED.

11. NEW DUCTWORK, PIPING, AND CONDUIT SHALL BE INSTALLED AS HIGH AS POSSIBLE. CONTRACTOR SHALL COORDINATE DUCTWORK, PIPING AND CONDUITS WITH LIGHTING FIXTURES, CEILING CONSTRUCTION, STRUCTURE AIR DISTRIBUTION EQUIPMENT, ETC., AND SHALL BE OFF-SET AS REQUIRED.

12. ITEMS LISTED AS DELEGATED DESIGN SHALL BE PROVIDED AND INCLUDE ENGINEER TO CONFORMING TO ALL APPLICABLE CODES, STANDARDS, AND OWNER REQUIREMENTS. SEALED DESIGN DOCUMENTS SHALL BE PROVIDED TO THE EOR AND OWNER FOR REVIEW PRIOR TO COMMENCING WITH ANY WORK RELATED TO INSTALATION OF APPLICABLE ITEMS.

13. PROVIDE CUTTING AND PATCHING OF ALL MATERIALS NECESSARY FOR THE INSTALLATION AS INDICATED OR SPECIFIED. CONTRACTOR SHALL TAKE SPECIAL CARE TO NEATLY REMOTE AND PROPERLY DISPOSE OF COMPENTED NO LONGER IN USE. PROTECT EXISTING CONDITIONS, AND SPACES, FINISHES, AND OTHER OWNER ITEMS RELATED TO OR IN THE VACINITY OF THE INSTALLATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE.

14. ALL WORK ASSOCIATED WITH THIS PROJECT SHALL BE PERFORMED IN COMPLIANCE WITH MSU PLANNING AND CONSTRUCTION STANDARDS.

MICHIGAN STATE UNIVERSITY
Infrastructure Planning and Facilities

MANLY MILES
AIR COOLED CHILLER

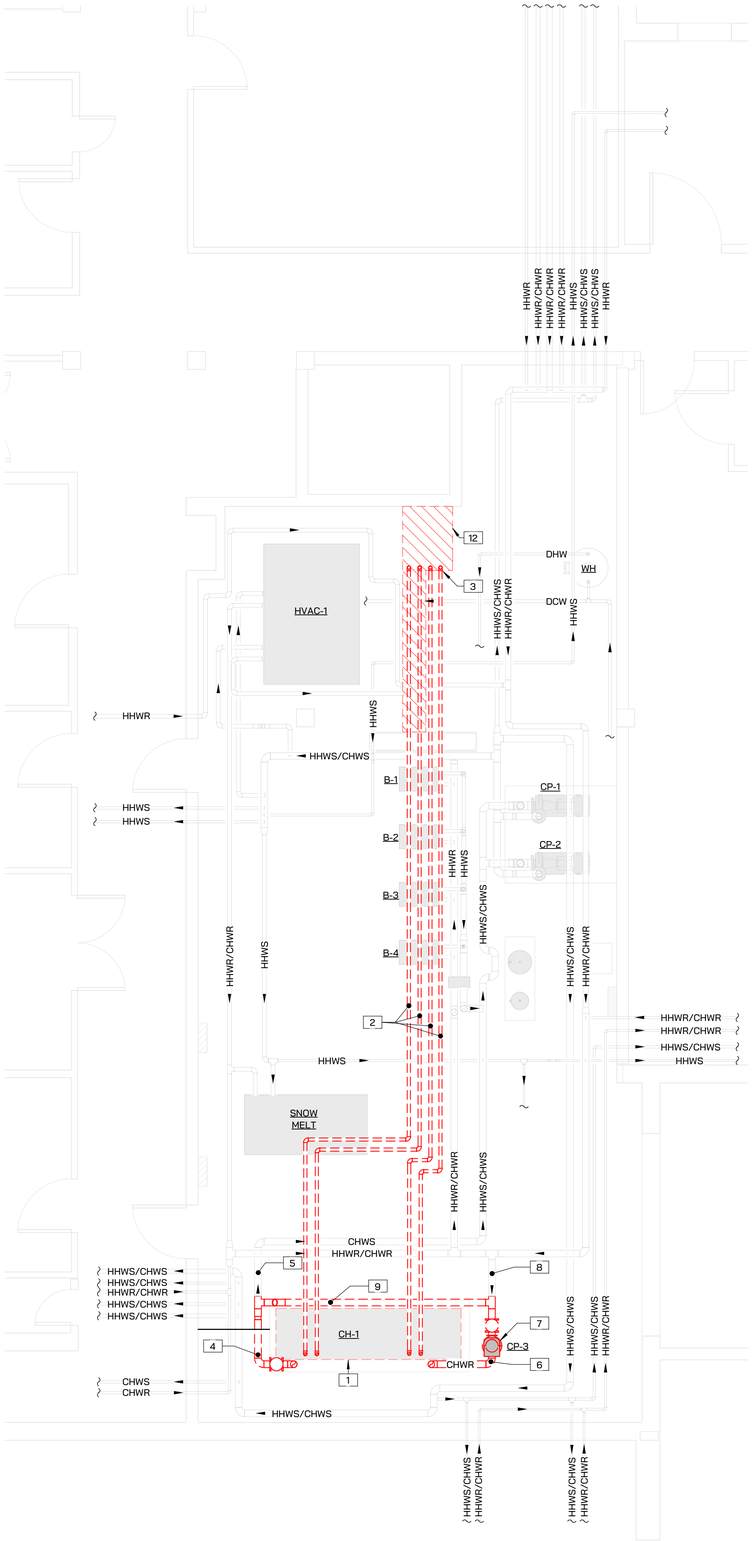
MSU PROJ. NO.
24.214

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

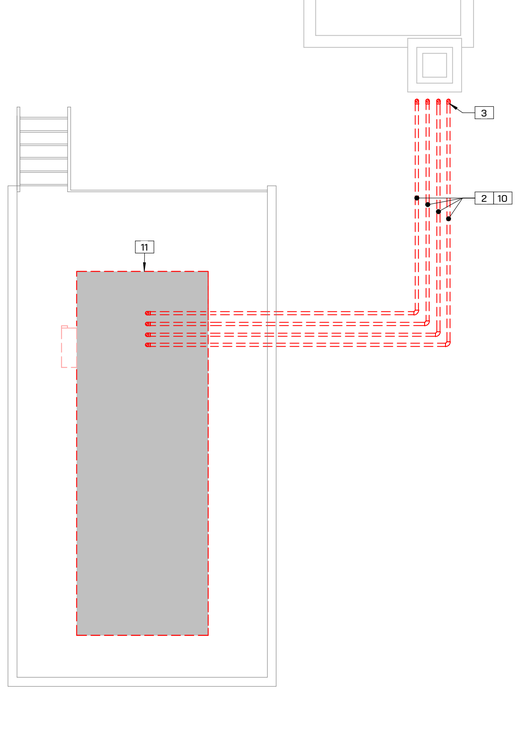
MECHANICAL SPECIFICATIONS

M001

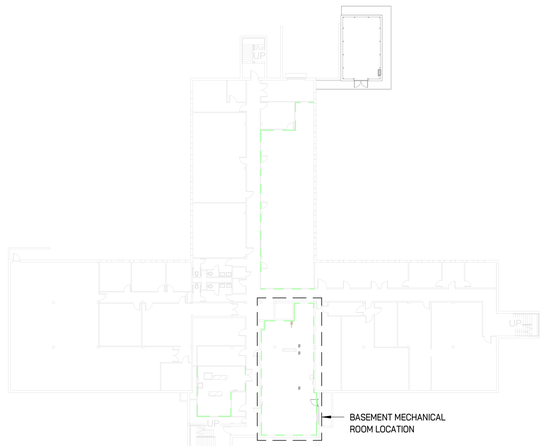
# OF #




PARTIAL BASEMENT MECHANICAL DEMOLITION PLAN
1/4" = 1'-0"




PARTIAL ROOF MECHANICAL DEMOLITION PLAN
1/4" = 1'-0"




BASEMENT KEY PLAN
1/32" = 1'-0"

## MECHANICAL DEMOLITION KEYED NOTES

1 REMOVE EXISTING CHILLER AND EQUIPMENT PAD. PATCH FLOORING TO MATCH EXISTING CONDITIONS.
2 REMOVE EXISTING REFRIGERANT PIPING.
3 REMOVE EXISTING REFRIGERANT PIPING. GENERAL TRADES TO OPEN CHASE FOR DEMO OF EXISTING PIPING ON FLOORS 1, 2, AND 3. PATCH OPENINGS AND PAINT TO MATCH EXISTING CONDITIONS.
4 REMOVE EXISTING CHWS PIPING AS SHOWN.
5 EXISTING CHWS PIPING TO REMAIN.
6 REMOVE EXISTING CHWR PIPING AS SHOWN.
7 REMOVE EXISTING CHILLER CIRCULATING PUMP.
8 EXISTING CHWR PIPING TO REMAIN.
9 BYPASS/DECOUPLER LINE REMOVED.
10 REMOVE EXISTING ROOF PIPE SUPPORTS.
11 REMOVE EXISTING CHILLER. EXISTING STRUCTURE TO REMAIN.
12 SAWCUT AND EXCAVATE AREA FOR NEW FLOOR DRAIN AND SANITARY LINE INSTALLATION. PATCH FLOOR TO MATCH EXISTING.

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# MANLY MILES
## AIR COOLED CHILLER

MSU PROJ. NO.
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| | |
|---|---|
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| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
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| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Status | |

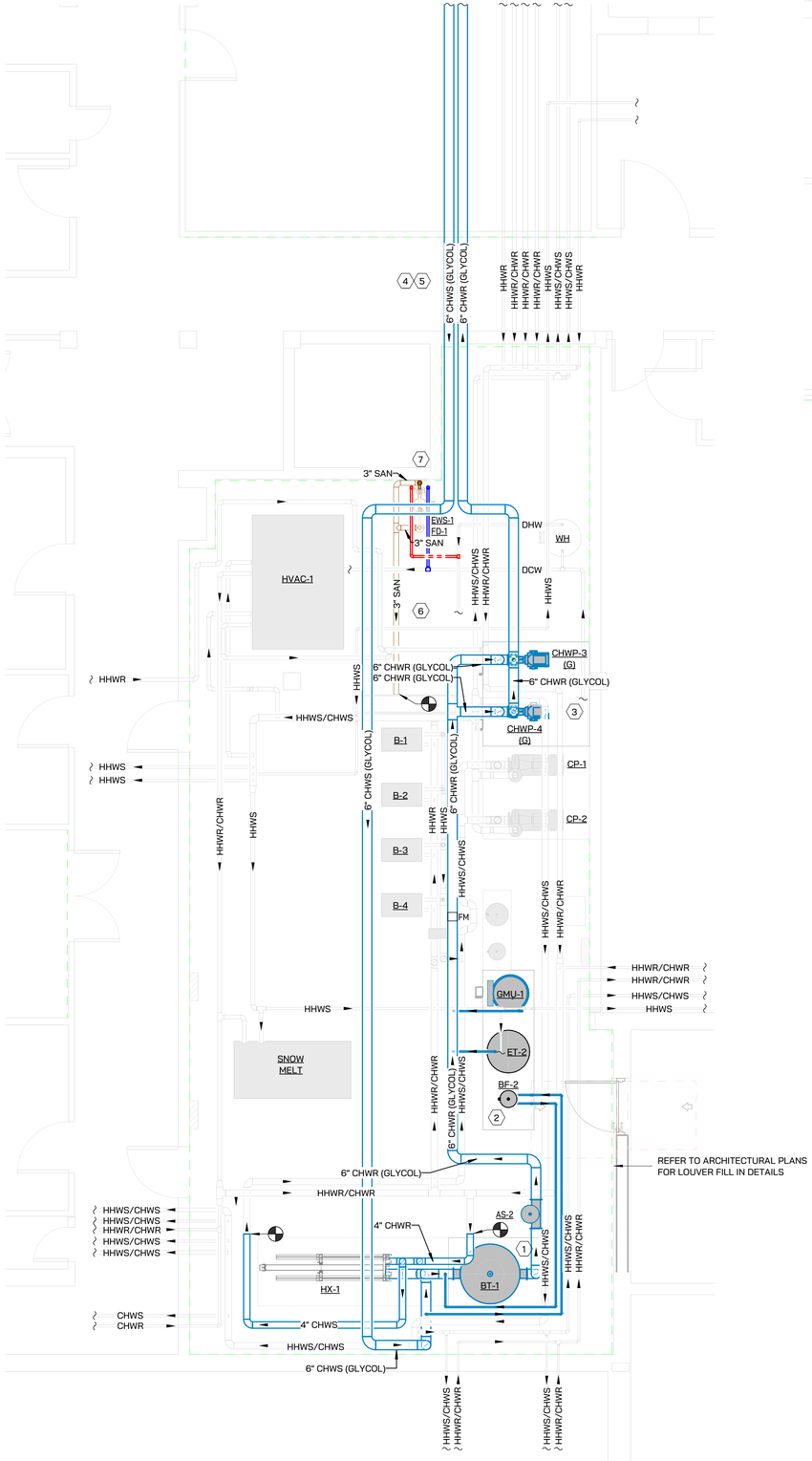
MECHANICAL DEMOLITION PLAN

MD100

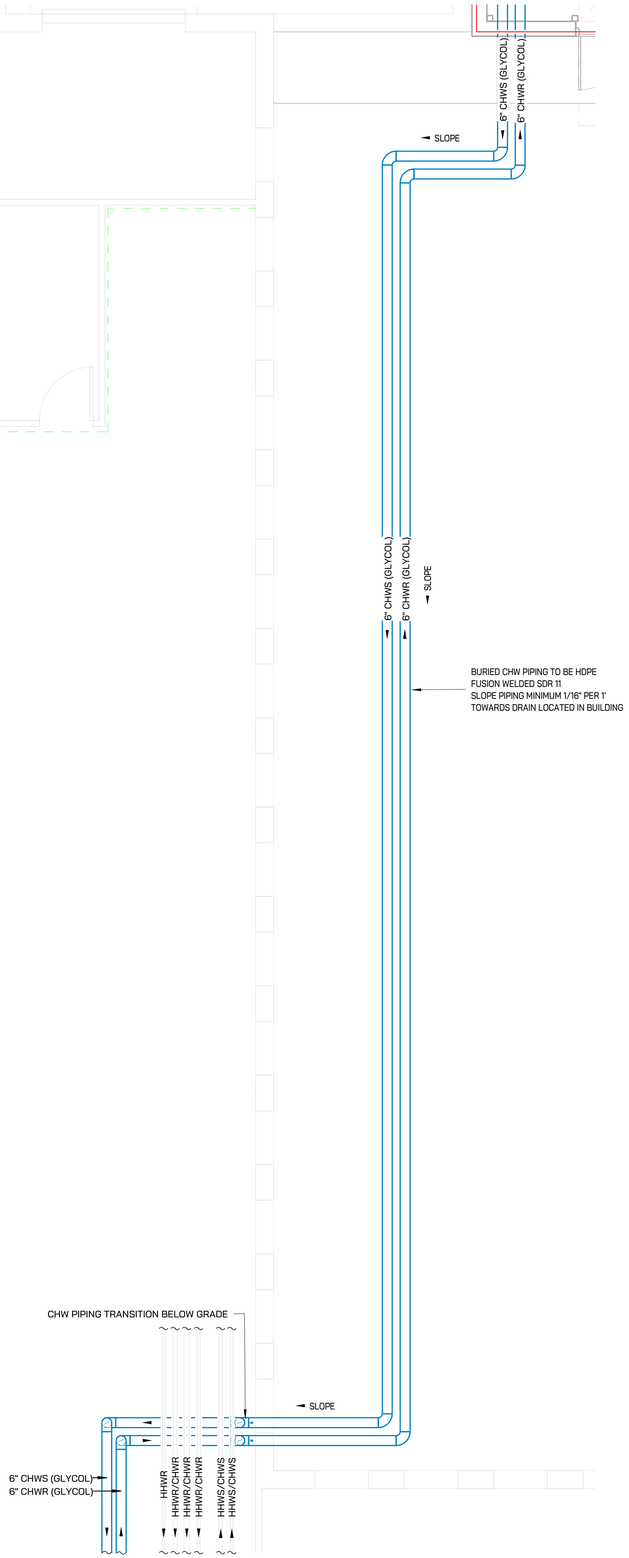
# OF #

## HVAC PIPING KEYED NOTES

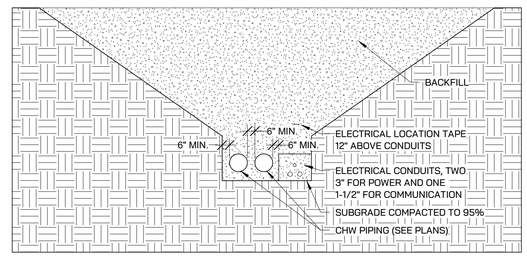
1. EXTEND CONCRETE PAD FOR NEW CHILLED WATER BUFFER TANK. REFER TO DETAIL 2 ON SHEET M501.
2. EXTEND CONCRETE PAD FOR NEW GLYCOL MAKEUP UNIT, EXPANSION TANK, AND BYPASS FEEDER. REFER TO DETAIL 2 ON SHEET M501.
3. EXTEND CONCRETE PAD FOR CHILLER PUMPS. REFER TO DETAIL 2 ON SHEET M501.
4. ROUTE PIPING CONCEALED ABOVE CEILING.
5. VERIFY ALL EXISTING PENETRATIONS THROUGH FIRE RATED ASSEMBLIES IN AREA OF WORK ARE PROPERLY SEALED. SEAL PENETRATIONS AS REQUIRED.
6. CONNECT SANITARY TO EXISTING TRENCH DRAIN.
7. 1 - 1/4" DCW AND DHW TO EMERGENCY WASH STATION. CONNECT TO EXISTING LINES. LOCATE MIXING VALVE IN ACCESSIBLE LOCATION ON WALL NEAR WASH STATION.




PARTIAL BASEMENT MECHANICAL PIPING PLAN
1/4" = 1'-0"




PARTIAL BASEMENT AND OUTDOOR MECHANICAL PIPING PLAN
1/4" = 1'-0"




1 M200 TRENCH DETAL - CHW PIPING
SCALE: NONE


BASEMENT KEY PLAN
1/32" = 1'-0"

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# MANLY MILES
## AIR COOLED CHILLER

MSU PROJ. NO.
24.214

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|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
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| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Status | |

BASEMENT HVAC PIPING PLAN

M200

# OF #

## HVAC PIPING KEYED NOTES

1 EXTEND CONCRETE PAD FOR NEW CHILLED WATER BUFFER TANK. REFER TO DETAIL 2 ON SHEET M501.

2 EXTEND CONCRETE PAD FOR NEW GLYCOL MAKEUP UNIT, EXPANSION TANK, AND BYPASS FEEDER. REFER TO DETAIL 2 ON SHEET M501.

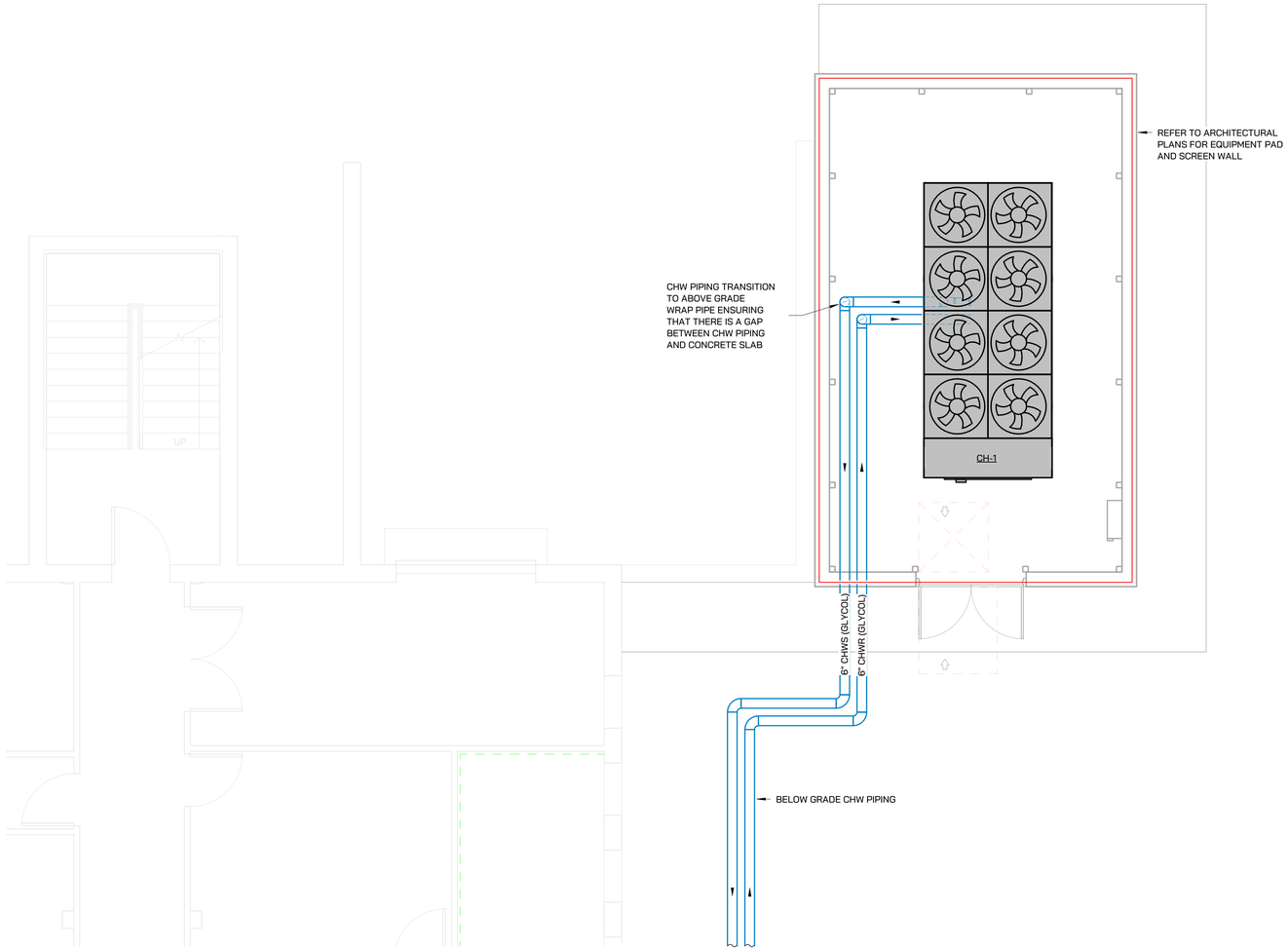
3 EXTEND CONCRETE PAD FOR CHILLER PUMPS. REFER TO DETAIL 2 ON SHEET M501.

4 ROUTE PIPING CONCEALED ABOVE CEILING.

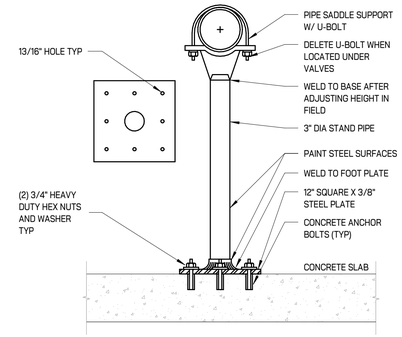
5 VERIFY ALL EXISTING PENETRATIONS THROUGH FIRE RATED ASSEMBLIES IN AREA OF WORK ARE PROPERLY SEALED. SEAL PENETRATIONS AS REQUIRED.

6 CONNECT SANITARY TO EXISTING TRENCH DRAIN.

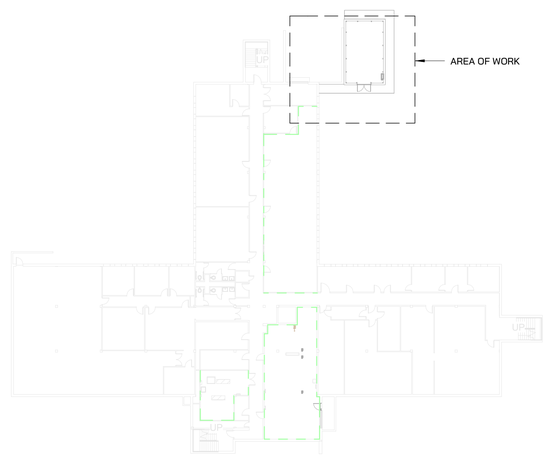
7 1 - 1/4" DCW AND DHW TO EMERGENCY WASH STATION. CONNECT TO EXISTING LINES. LOCATE MIXING VALVE IN ACCESSIBLE LOCATION ON WALL NEAR WASH STATION.




CHILLER HVAC PIPING PLAN
1/4" = 1'-0"




1 / M210 PIPE STAND DETAIL
SCALE: NONE




BASEMENT KEY PLAN
1/32" = 1'-0"

MICHIGAN STATE UNIVERSITY
Infrastructure Planning and Facilities

MANLY MILES
AIR COOLED CHILLER

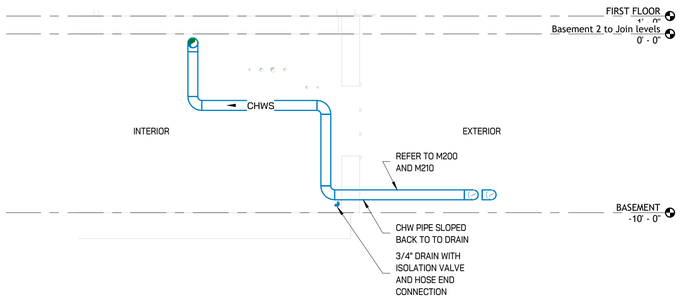
MSU PROJ. NO.
24.214

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Status | |

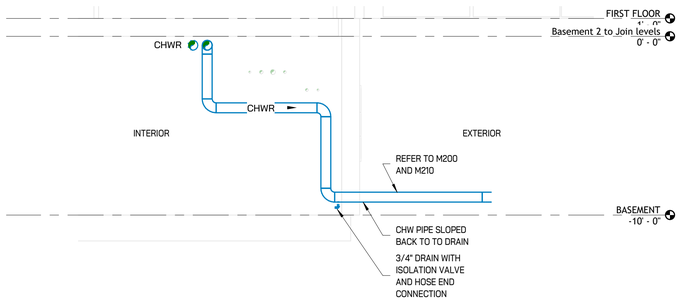
CHILLER HVAC PIPING PLAN

M210

# OF #




① CHWS INTERIOR DRAIN SECTION
1/4" = 1'-0"




② CHWR INTERIOR DRAIN SECTION
1/4" = 1'-0"

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| | |
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| L.A. | |
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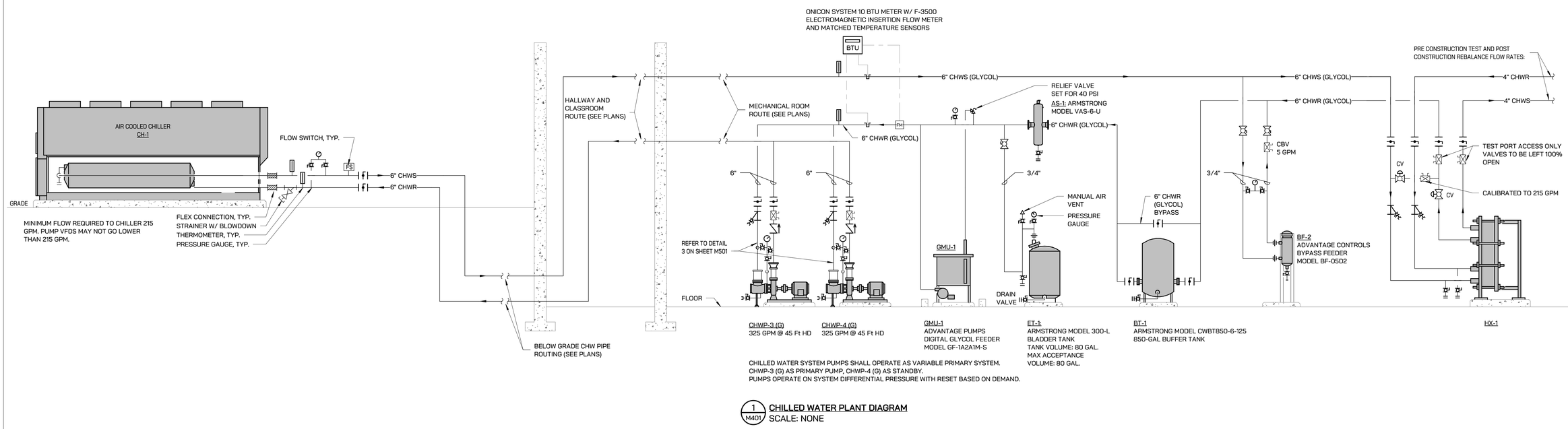
| DATE | 03/21/2025 |
| SCALE | 1/4" = 1'-0" |
| ISSUED | |
| Project Status | |

MECHANICAL SECTIONS

M301

# OF #




1 / M401 CHILLED WATER PLANT DIAGRAM
SCALE: NONE

MICHIGAN STATE UNIVERSITY
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MANLY MILES BUILDING
AIR COOLED CHILLER

MSU PROJ. NO.
24.214

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|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

MECHANICAL SYSTEM DIAGRAMS

M401

# OF #

## PUMP SCHEDULE

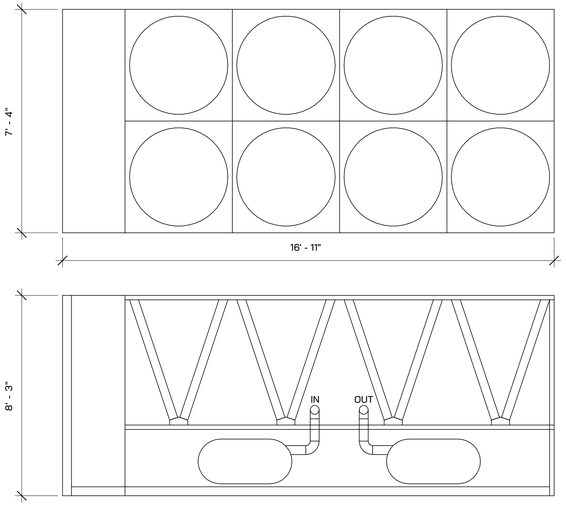
| MARK | MANUFACTURER | MODEL | GPM | HEAD | HP | RPM | VOLTAGE | SERVICE | LOCATION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| CHWP-3 (G) | ARMSTRONG FLUID TECHNOLOGY | SERIES DESIGN ENVELOPE SENSORLESS 4200H 2505-005.0 WITH SUCTION GUIDE | 325 | 45 | 5 | 3078 | 460/3/60 | CH-1 | MECHANICAL ROOM | 1, 2, 3 |
| CHWP-4 (G) | ARMSTRONG FLUID TECHNOLOGY | SERIES DESIGN ENVELOPE SENSORLESS 4200H 2505-005.0 WITH SUCTION GUIDE | 325 | 45 | 5 | 3078 | 460/3/60 | CH-1 | MECHANICAL ROOM | 1, 2, 3 |

NOTES:
1.) SELECTION BASED ON 33% PROPYLENE GLYCOL SOLUTION.
2.) VARIABLE FREQUENCY DRIVE SHALL BE YASKAWA HV600.. ALL AVAILABLE POINTS SHALL BE REVEALED TO THE BMS.
3.) PROVIDE SUCTION DIFFUSER ARMSTRONG MODEL SG-63. PIPE CONN. SIZE 6", PUMP CONN. SIZE 3", PRESSURE DROP 0.5'.

## HEAT EXCHANGER

| | | | HOT SIDE | | | | | COLD SIDE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MARK | MANUFACTURER | MODEL | FLUID | GPM | INLET TEMPERATURE (°F) | OUTLET TEMPERATURE (°F) | WPD (FT) | FLUID | GPM | INLET TEMPERATURE (°F) | OUTLET TEMPERATURE (°F) | WPD (FT) |
| HX-1 | ALFA LAVAL | AQ4L-FG | WATER | 362.6 | 54 | 44 | 8.3 | 33% PROPYLENE GLYCOL | 325 | 41 | 53 | 9.2 |

NOTES:
1.) APPROXIMATE OUTER DIMENSIONS 92.3" X 18.9" X 75.7".
2.) INCLUDE STAND FOR EQUIPMENT PAD MOUNTING.




## CH-01

**AIR-COOLED CHILLER**

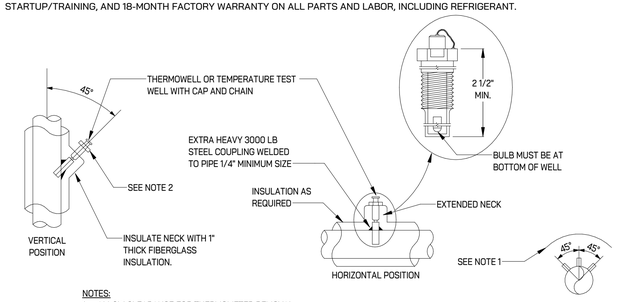
TYPE: 150 TON NOMIAL AIR-COOLED VARIABLE-SPEED ROTARY SCREW CHILLER
BASED ON: "QUANTECH" MODEL QTC40200B0
WEIGHT: 11812 LB (SHIPPING), 12328 LB (OPERATING)
REFRIGERANT: R-513A, 154 LB CHARGE PER CIRCUIT, TWO CIRCUITS, 308 LB TOTAL

EVAPORATOR: HYBRID FALLING FILM HEAT EXCHANGER
CAPACITY: 150 TONS (DESIGN CONDITIONS)
150 TONS (AHRI)
kW/TON: 100%: 1.56 (DESIGN CONDITIONS)
100%: 1.22 (AHRI)
IPLV: 15.49 EER (DESIGN CONDITIONS)
18.22 EER (AHRI)
53.00°F EWT, 41.00°F LWT, 320.9 GPM, 10.7 FT WPD FOR NORMAL OPERATION
33% PROPLYLENE GLYCOL MIXTURE, 215 GPM MIN. FLOW

CONDENSER: 4G MICROCHANNEL COIL (25MM), LOW SOUND FANS
VARIABLE SPEED DIRECT DRIVE MOTORS
FANS: 8
COMPRESSORS: 2 VARIABLE SPEED SCREW
ENTERING AIR TEMPERATURE: 95°F DB

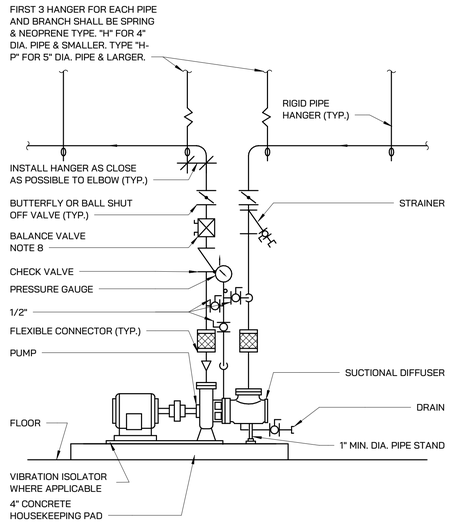
ELECTRICAL: SINGLE-POINT POWER CONNECTION WITH NON-FUSED DISCONNECT W/ LOCKING HANDLE, VARIABLE SPEED DRIVE, 480/3/60, 234 kW, 363.0 MCA, 500 MOP, 25,000 AIC RATED MINUMUM

OPTIONS: PROVIDE WITH ELASTOMERIC ISOLATORS, WATER BOX HEATERS, FLOW SWITCH, WIRE/LOUVERED ENCLOSURE PANELS, BAS/EMS TEMPERATURE RESET CONTROL, BACNET COMMUNICATIONS INTERFACE, OWNER STARTUP/TRAINING, AND 18-MONTH FACTORY WARRANTY ON ALL PARTS AND LABOR, INCLUDING REFRIGERANT.




NOTES:
1. ALLOW CLEARANCE FOR THERMOMETER REMOVAL.
2. TO NOT INSTALL WELL BELOW POSITION SHOWN.
3. INSULATION WITH OR WITHOUT VAPOR BARRIER AS REQUIRED.
4. SELECT COUPLING DIAMETER TO ACCOMMODATE TEST WELL.
5. TEST WELL (TYPICAL) TO BOLTON TYPE 600 SERIES OR H.O. TRERICE SERIES 5550 OR 5590 COMPLETE WITH CAP AND CHAIN.
6. TEST WELL ILLUSTRATED; INSTALL THERMOWELL WITH SAME CONSTRAINTS 3/4" MINIMUM SIZE.

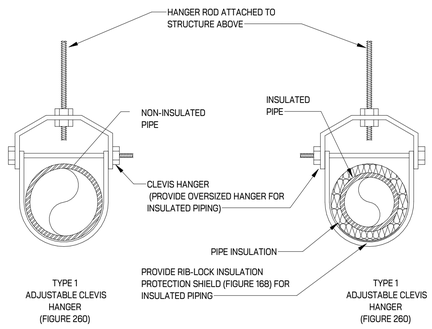
6 M501 **THERMOWELL OR THERMOMETER TEST WELL INSTALLATION**
SCALE: NONE




NOTES:

1. FLEXIBLE COUPLINGS FOR GROOVED SYSTEM MAY BE USED IN LIEU OF FLEXIBLE CONNECTIONS. INSTALL PER MANUFACTURER'S RECOMMENDATIONS
2. REFER TO MSU STANDARDS OF CONSTRUCTION FOR GROUTING SPECIFICS
3. BUTTERFLY VALVE NOT ACCEPTABLE FOR BALANCING
4. TRIPLE DUTY VALVES NOT ACCEPTABLE
5. REFER TO MSU STANDARDS OF CONSTRUCTION FOR INSULATION REQUIREMENTS
6. EXTEND HOUSEKEEPING PAD AT LEAST 3" WIDER THAN BASE AND SUPPORT LEG AREA
7. UTILIZE HARD PIPE FOR DIFFERENTIAL PRESSURE GAUGE ASSEMBLY. IN LIEU OF HARD PIPING ASSEMBLY, CONTRACTOR HAS THE OPTION OF SUPPLYING/INSTALLING THREE GAUGES WITH VALVES. THE USE OF RUBBER HOSE IS NOT PERMITTED
8. BALANCE VALVE NOT REQUIRED ON PUMP DISCHARGE WHEN PUMPS HAVE VFD'S

3 M501 **BASE MOUNTED END SUCTION PUMP PIPING DIAGRAM**
SCALE: NONE



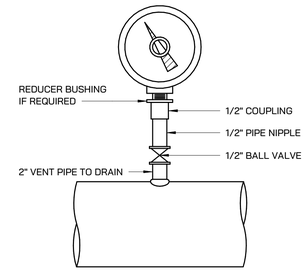

(FIGURE CT-65 FOR COPPER TUBING)

NOTE:
FIGURE NUMBERS ARE TYPICAL TO GRINNELL SUPPORT NUMBERS.

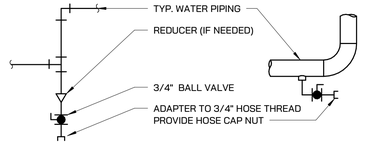
7 M501 **SINGLE PIPE CLEVIS HANGER**
SCALE: NONE

**FD-1**
ASME A112.6-2001, DUCO CAST IRON BODY WITH FLASHING COLLAR AND ADJUSTABLE STRAINER HEAD. JAY R. SMITH MODEL 2005.

**EWS-1**
GUARDIAN SAFETY STATION WITH EYEWASH, ALL STAINLESS STEEL MODEL G1991. ANSI / ISEA Z358.1 COMPLIANT.



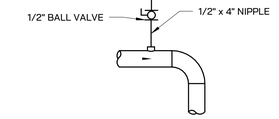

1 M501 **PRESSURE GAUGE INSTALLATION DETAIL**
SCALE: NONE




TYPICAL CHILLED AND HOT WATER PIPING VALVE CONNECTIONS

NOTES:

1. DRAIN ALL LOW POINTS AS INDICATED ABOVE.
2. WHERE SCALE POCKETS ARE SHWON ON PIPE RISER DIAGRAMS AND/OR PLANS LOCATE DRAIN AT BOTTOM OF SCALE POCKET.

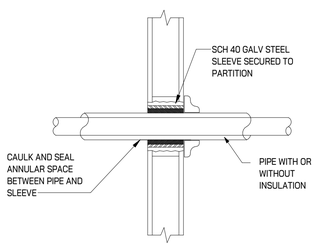



TYPICAL MANUAL AIR VENT

NOTES:

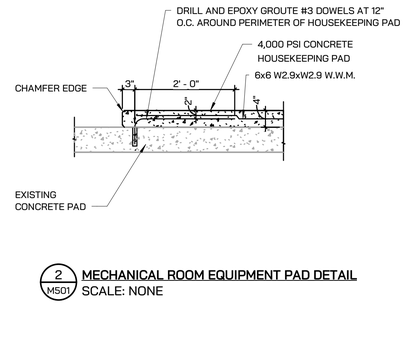
1. VENT ALL HIGH POINTS INDUCTED ABOVE.
2. IF AUTOMATIC AIR VENTS ARE USED, PIPE DISCHARGE TO DRAIN.

4 M501 **DRAIN VALVE AND AIR VENT CONNECTIONS (HYDRONIC SYSTEMS)**
SCALE: NONE

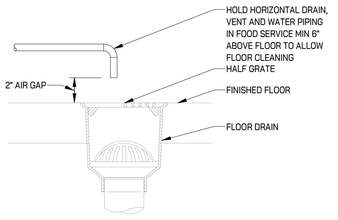



NOTES:
1. TYPICAL FOR NON-INSULATED PIPE AND CONDUIT.
2. ALL CAULKING AND SEALANT SHALL BE FIRE RATED (SEE SPECIFICATIONS).
3. WHERE PIPING IS EXPOSED AT FINISHED WALL, FLUSH MOUNT SLEEVE AND PROVIDE AN ESCUTCHEON PLATE.

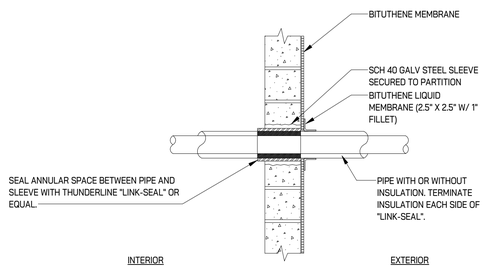
8 M501 **PIPE PENETRATION THRU INTERIOR WALLS**
SCALE: NONE




2 M501 **MECHANICAL ROOM EQUIPMENT PAD DETAIL**
SCALE: NONE




5 M501 **DRAIN TO FLOOR SINK**
SCALE: NONE




NOTES:
1. TYPICAL FOR NON-INSULATED PIPING AND CONDUIT.
2. TYPICAL FOR MASONRY OR CONCRETE WALL.
3. FOR WALL PENETRATION WITH FIRE RATINGS GREATER THAN (1) HOUR, USE THUNDERLINE "PYRO-PAC" SEALS OR EQUAL.
4. WHERE PIPING EXPOSED AT FINISHED WALL, FLUSH MOUNT SLEEVE, AND PROVIDE AN ESCUTCHEON PLATE.

10 M501 **PIPE PENETRATION THRU EXTERIOR WALLS**
SCALE: NONE

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AIR COOLED CHILLER

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| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
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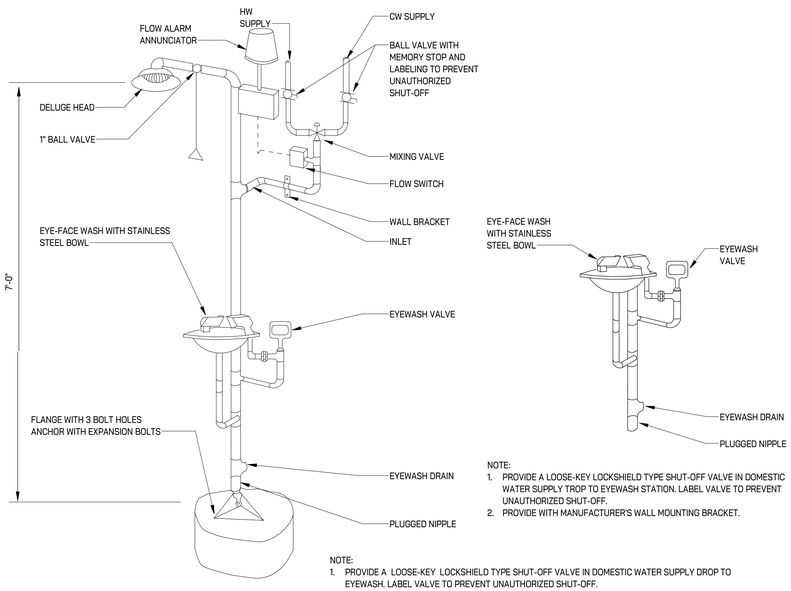
MECHANICAL SCHEDULES

M501

# OF #




NOTE:
1. PROVIDE A LOOSE-KEY LOCKSHIELD TYPE SHUT-OFF VALVE IN DOMESTIC WATER SUPPLY DROP TO EYEWASH. LABEL VALVE TO PREVENT UNAUTHORIZED SHUT-OFF.




NOTE:
1. PROVIDE A LOOSE-KEY LOCKSHIELD TYPE SHUT-OFF VALVE IN DOMESTIC WATER SUPPLY TROP TO EYEWASH STATION. LABEL VALVE TO PREVENT UNAUTHORIZED SHUT-OFF.
2. PROVIDE WITH MANUFACTURER'S WALL MOUNTING BRACKET.

1 / M510 **EMERGENCY EYEWASH PIPING DETAIL**
SCALE: NONE

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MECHANICAL DETAILS

M510

# OF #

AIR COOLED CHILLER SEQUENCE OF OPERATIONS:

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR AIR COOLED CHILLED WATER SYSTEM OPERATION. SYSTEM IS A COMBINATION OF VARIABLE VOLUME BASE MOUNTED CENTRIFUGAL PUMP(S), VARIABLE FREQUENCY CONTROLLER(S), AIR-COOLED CHILLER WITH FACTORY FURNISHED BACNET INTERFACE CONTROLLER, WATER TO WATER HEAT EXCHANGER, CONTROL VALVE (CV) AND ACTUATOR, SIDE STREAM FILTER, GLYCOL MAKE-UP UNIT AND WATER TEMPERATURE/AIR TEMPERATURE/FLOW SENSOR(S).
2. SYSTEM ENABLED BASED ON THE FOLLOWING:
   A. UPON A CALL FOR MECHANICAL COOLING BY ANY PIECE OF COOLING EQUIPMENT.
      a. INCLUDE THE CAPABILITY TO OMIT ANY INDIVIDUAL PIECE OF COOLING EQUIPMENT.
   B. AT AN ADJUSTABLE 55°F OUTDOOR AIR TEMPERATURE.
   C. BY OPERATOR COMMAND.
3. SYSTEM START /STOP , CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN INDEXED TO STOP:
      a. DISABLE CHILLER CONTROLLER.
      b. AFTER DELAY OF TEN (10) MINUTE HOLD, DISABLE PUMP(S).
   B. WHEN INDEXED TO START:
      a. AFTER DELAY OF TEN (10) MINUTE AND ISOLATION CV HAS PROVEN OPEN, ENABLE LEAD PUMP (PRIMARY).
      b. AFTER DELAY OF TEN (10) MINUTE HOLD TO ESTABLISH FLOW IN SYSTEM, ENABLE CHILLER CONTROLLER.
4. PRIMARY PUMP CONTROL,- SYSTEM CONTROLLER SHALL MODULATE PUMP MOTOR(S) VARIABLE FREQUENCY CONTROLLER(S) TO MAINTAIN A TEMPERATURE DIFFERENTIAL (12°F) SETPOINT MEASURED BY TEMPERATURE SENSOR'S LOCATED ON MAIN RETURN AND SUPPLY OF SYSTEM.
   A. AS PUMPS TURN DOWN AND ADDITIONAL FLOW VOLUME IS REQUIRED FOR THE CHILLER MINIMUM FLOW RATE, MODULATE HEAT EXCHANGER BYPASS CONTROL VALVE TO MAINTAIN MINIMUM FLOW THROUGH CHILLER (215 GPM).
   B. SETPOINT TO BE DETERMINED BY TEST AND BALANCE CONTRACTOR.
5. CHILLER CONTROL - WHEN SYSTEM IS ENABLED AND LEAD PRIMARY PUMP HAS PROVED "ON" STATUS, ASSOCIATED CHILLER AND PACKAGED CONTROLS WILL BE ENABLED BY DDC.
   A. CHILLER PACKAGED CONTROLS WILL CONTROL TO DDC CHILLED WATER SETPOINT OF 40°F (ADJ.).
6. HEAT EXCHANGER OUTPUT CONTROL – WHEN SYSTEM IS ENABLED AND LEAD PRIMARY PUMP HAS PROVED "ON" STATUS, MODULATE HEAT EXCHANGER CONTROL VALVE TO MAINTAIN THE BUILDING SIDE CHILLED WATER TEMPERATURE SETPOINT OF 44°F (ADJ).
7. SYSTEM CONTROLLER SHALL MONITOR CHILLED WATER SYSTEM GALLON PER MINUTE (GPM) FOR THE FOLLOWING:
   A. PRIMARY CHILLED WATER LOOP.
   B. SECONDARY CHILLED WATER LOOP.
8. EMERGENCY POWER CONTROL – WHEN BUILDING IS ON EMERGENCY POWER, SYSTEM CONTROLLER SHALL RESPOND BASED ON THE FOLLOWING:
   A. SYSTEM SHALL BE DISABLED DURING EMERGENCY POWER.

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| Project Status | |

TEMPERATURE CONTROLS

M601

# OF #

# ELECTRICAL ABBREVIATION LIST

| ABBREVIATION | DESCRIPTION |
|---|---|
| A | AMPERES |
| AF | AMPERES FRAME (BREAKER RATING) |
| AFCI | ARC FAULT CIRCUIT INTERRUPTER |
| A.F.F. | ABOVE FINISH FLOOR |
| AIC | AMPS INTERRUPTING CAPACITY |
| AL | AUDIENCE LEFT |
| AR | AUDIENCE RIGHT |
| AT | AMPERS TRIP (BREAKER SETTING) |
| ATS | AUTOMATIC TRANSFER SWITCH |
| AUX | AUXILIARY |
| BKR | BREAKER |
| BPS | BOLTED PRESSURE SWITCH |
| C | CONDUIT |
| CB | CIRCUIT BREAKER |
| CKT | CIRCUIT |
| CT | CURRENT TRANSFORMER |
| DEMO | DEMOLITION |
| DIM | DIMENSION |
| DISC | DISCONNECT |
| DP | DISTRIBUTION PANEL |
| DS | DOWNSTAGE |
| DWG | DRAWING |
| EBU | EMERGENCY BATTERY UNIT |
| EC | ELECTRICAL CONTRACTOR |
| ELEC | ELECTRICAL |
| EM/ EMERG | EMERGENCY |
| EMT | ELECTRICAL METALLIC TUBING |
| EO | ELECTRICALY OPERATED |
| EPO | EMERGENCY POWER OFF |
| EWC | ELECTRIC WATER COOLER |
| EXIST | EXISTING |
| EXT | EXTERIOR |
| FA | FIRE ALARM |
| FLA | FULL LOAD AMPS |
| FLR | FLOOR |
| FOH | FRONT OF HOUSE |
| FSEC | FOOD SERVICE EQUIPMENT |
| FU | FUSE |
| G/GRD/EG | GROUND |
| GFCI | GROUND FAULT CIRCUIT INTERRUPTER |
| GFP | GROUND FAULT PROTECTION |
| HOA | HAND-OFF-AUTO |
| HP | HORSEPOWER |
| HV | HIGH VOLTAGE |
| HZ | HERTZ |
| IG | ISOLATED GROUND |
| JB | JUNCTION BOX |
| KV | KILOVOLT |
| KVA | KILOVOLT - AMPERES |
| KW | KILOWATT |
| KWH | KILOWATT - HOURS |
| LA | LIGHTING ARRESTOR |
| LP | LIGHTING PANEL |
| LDP | LIGHTING DISTRIBUTION PANEL |
| MAX | MAXIMUM |
| MCB | MAIN CIRCUIT BREAKER |
| MCC | MOTOR CONTROL CENTER |
| MDP | MAIN DISTRIBUTION PANEL |
| MECH | MECHANICAL |
| MIN | MINIMUM |
| MISC. | MISCELLANEOUS |
| MLO | MAIN LUGS ONLY |
| MTD | MOUNTED |
| MTG | MOUNTING |
| MTR | MOTOR |
| N | NEUTRAL |
| NC | NORMALLY CLOSED |
| NEC | NATIONAL ELECTRICAL CODE |
| NF | NON-FUSIBLE |
| NIC | NOT IN CONTRACT |
| NL | NIGHT LIGHT |
| NO | NORMALLY OPEN |
| NTS | NOT TO SCALE |
| OC | ON CENTER |
| OFCI | OWNER FURNISHED, CONTRACTOR INSTALLED |
| OFOI | OWNER FURNISHED, OWNER INSTALLED |
| P | POLE |
| PB | PUSHBUTTON STATION |
| PH | PHASE |
| PT | POTENTIAL TRANSFORMER |
| PDP | POWER DISTRIBUTION PANEL |
| RECEPT. | RECEPTACLE |
| RCP | RECEPTACLE |
| RDP | RECEPTACLE DISTRIBUTION PANEL |
| RP | RECEPTACLE PANEL |
| RSC | RIGID STEEL CONDUIT |
| SCHED | SCHEDULE |
| SW | SWITCH |
| SWBD | SWITCHBOARD |
| SWGR | SWITCHGEAR |
| TB | TERMINAL BOX |
| TELECOM | TELECOMMUNICATIONS |
| TR | TAMPER RESISTANT |
| TTP | TELEPHONE TERMINAL BACKBOARD |
| TYP | TYPICAL |
| UNO | UNLESS OTHERWISE NOTED |
| US | UPSTAGE |
| V | VOLTS |
| W | WIRE OR WATTS |
| WG | WIRE GUARD |
| WP | WEATHERPROOF |
| XFMR | TRANSFORMER |
| XP | EXPLOSION PROOF |
| (E) | EXISTING |
| (R) | RELOCATED |

NOTE: SOME SYMBOLS AND ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.

# ELECTRICAL SYMBOL LIST

| SYMBOL | DESCRIPTION |
|---|---|
| | LIGHTING FIXTURE - ARCHITECTURAL TROFFER |
| | EMERGENCY LIGHTING FIXTURE |
| | LIGHTING FIXTURE - PENDANT |
| | WALL MOUNTED LIGHTING FIXTURE |
| | LIGHTING FIXTURE |
| | EXIT LIGHTING FIXTURE WITH DIRECTIONAL ARROWS (SHADED AREA INDICATES FACE) |
| | EXIT LIGHTING FIXTURE WITH DIRECTIONAL ARROWS (SHADED AREA INDICATES FACE) |
| | EXIT LIGHTING FIXTURE - WALL MOUNTED |
| S | SINGLE POLE TOGGLE SWITCH |
| $S_{OS}$ | DIMMER OCCUPANCY SENSOR SWITCH |
| $S_{LV}$ | LOW VOLTAGE DIMMER SWITCH |
| OS | OCCUPANCY SENSOR DEVICE - CEILING |
| OS | OCCUPANCY SENSOR DEVICE - WALL |
| | SIMPLEX / DUPLEX RECEPTACLE |
| | QUAD RECEPTACLE |
| | ABOVE COUNTER DUPLEX RECEPTACLE (SIMILAR FOR TAMPER RESISTANT, QUADS, EMERGENCY AND GFI RECEPTACLES) |
| $GFI$ | DUPLEX RECEPTACLE-GROUND FAULT CIRCUIT INTERRUPTER |
| $USB$ | USB RECEPTACLE |
| FB | FLOOR BOX ASSEMBLY - LEGRAND EVOLUTION SERIES OR EQUAL |
| EQ | EQUIPMENT CONNECTION - REFER TO ELECTRICAL FEEDER AND PANEL SCHEDULE FOR BREAKER AND CONDUCTOR SIZE/QUANTITY |
| J | JUNCTION BOX |
| | EMPTY BOX FOR FUTURE TELECOMMUNICATION OUTLET |
| S | SPEAKER |
| S | SPEAKER - WALL MOUNTED |
| | SINGLE FACE CLOCK - CEILING MOUNTED |
| | SINGLE FACE CLOCK - WALL MOUNTED |
| | CIRCUIT BREAKER |
| | AUTOMATIC OR MANUAL TRANSFER SWITCH |
| X | PANELBOARD "X" INDICATES PANELBOARD NAME |
| | BRANCH CIRCUIT PANEL BOARD |

# ELECTRICAL SPECIFICIATION

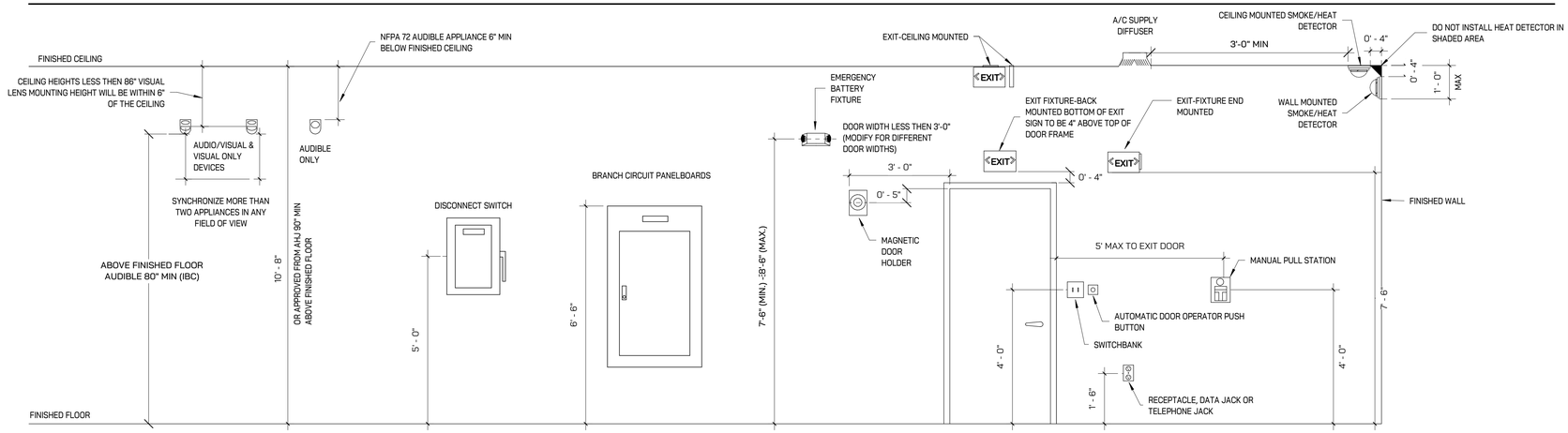
1. FOLLOW ALL MICHIGAN STATE UNIVERSITY STANDARDS.
2. CONTRACTOR TO PROCURE ALL REQUIRED BUILDING PERMITS AND INSPECTIONS TO COMPLETE PROJECT.
3. ALL WORK SHALL BE PERFORMED IN ACCORDINANCE WITH THE MICHIGAN ELECTRICAL CODE.
4. PROVIDE NEW ELECTRICAL SERVICES FROM CONSUMERS ENERGY AS INDICATED. COORDINATE SCOPE OF WORK AND PROVIDE ALL WORK TO PROVIDE A FULLY FUNCTIONAL ELECTRICAL SERVICE.
5. REMOVE ALL ELECTRICAL EQUIPMENT, WIRE, CONDUIT, ETC ASSOCIATED WITH DEMOLISHED EQUIPMENT.
6. REMOVE ALL ABANDONDED ELECTRICAL CONDUIT AND WIRE BACK TO SOURCE.
7. PROVIDE SHOP DRAWINGS FOR THE FOLLOWING:
   A. CONDUIT.
   B. CONDUCTORS.
   C. WIRING DEVICES INCLUDING COVERPLATES.
   D. DISCONNECT SWITCHES, ENCLOSED CIRCUIT BREAKERS AND FUSED SWITCHES.
   E. INTERIOR LIGHT FIXTURES.
   F. LIGHTING CONTROL SYSTEM AND DEVICES.
8. PATCH, REPAIR, AND PAINT ANY OPENINGS THROUGH ROOF, CEILINGS, WALLS, OR FLOORS TO MATCH EXISTING CONDITION.
9. THE OWNER SHALL HAVE FIRST RIGHT OF REFUSAL OF ALL DEMOLISHED EQUIPMENT.
10. PROVIDE LAMACOID LABELS FOR:
    A. PANELBOARDS AND SWITCHBOARDS.
    B. TRANSFORMERS.
    C. DISCONNECT SWITCHES.
    D. VARIABLE FREQUENCY DRIVES.
    E. LIGHTING CONTROL PANELS. LABEL SHALL INDICATE ROOMS CONTROLLED.
11. MINIMUM CONDUIT SIZE SHALL BE 1/2" TRADE SIZE.
12. USE THE CONDUIT TYPE SUITABLE FOR THE ENVIRONMENT IN WHICH IS IS LOCATED:
    A. INDOORS: EMT WITH SET SCREW FITTINGS. MC CABLE IS ACCEPTABLE FOR BRANCH CIRCUITS WHERE CONCEALED.
    B. OUTDOORS: RIGID GALVANIZED STEEL.
    C. UNDERGROUND: RIGID NON METALLIC SCHEDULE 80 PVC.
    D. CONDUIT EXITING FROM UNDERGROUND SHALL TRANSITION TO EMT/RGS PRIOR TO BEING EXPOSED.
13. PROVIDE CONDUIT SLEEVES FOR LOW VOLTAGE DATA CABLING.
14. ALL CABLING SHALL BE IN CONDUIT UNLESS ABOVE AN ACCESSIBLE CEILING WHERE "J" HOOKS ARE ACCEPTABLE.
15. USE CONDUIT SWEEPS FOR ALL DATA CABLING CONDUITS.
16. MINIMUM CONDUCTOR SIZE FOR POWER SHALL BE #12 AWG. ANY BRANCH CIRCUITS OVER 100' IN LENGTH SHALL BE #10 AWG MINIMUM FOR VOLTAGE DROP.
17. PROVIDE THHN-2 COPPER INDOORS AND THWN-2 COPPER OUTDOORS, UNLESS NOTED OTHERWISE OR DICTATED OTHERWISE BY THE NEC.
18. PROVIDE GROUNDING ELECTRODE SYSTEM AND EQUIPMENT GROUNDING PER THE NATIONAL ELECTRIC CODE.
19. PANELBOARDS SHALL BE FULLY RATED, SERIES RATED PANELS ARE NOT ACCEPTABLE. HAVE HINGED SWING DOOR-IN-DOOR. LOAD CENTERS ARE NOT ACCEPTABLE. SQUARE D NQOD OR EQUAL FOR 208/120V BRANCH PANELBOARDS. SQUARE D NF OR EQUAL FOR 480/277V PANELBOARDS. PROVIDE TYPED PANELBOARD CIRCUIT LABEL CARDS. UPDATE ALL EXISTING LABEL CARDS AS REQUIRED.
20. ALL FLOOR MOUNTED EQUIPMENT SHALL BE ON 4" HOUSEKEEPING PAD.
21. ALL DEVICE COVERS SHALL MATCH DEVICE COLOR UNLESS STAINLESS STEEL COVERS ARE SPECIFIED.
22. WEATHERPROOF RECEPTACLE COVERS SHALL BE METAL, WHILE-IN-USE TYPE.
23. SWITCHES SHALL BE HEAVY DUTY GRADE, 20 AMP, QUIET TYPE, WHITE UNLESS NOTED OTHERWISE.
24. LIGHTING CONTROL DEVICES SHALL BE MANUFACTURED BY N-LIGHT, UNLESS NOTED OTHERWISE.
25. ALL LIGHTING CONTROLS SHALL BE MEET ASHRAE 90.1 - 2013 WITH MICHIGAN AMENDMENTS.
26. IT IS UNDERSTAND AND AGREED BY THE INSTALLER THAT WORK HEREIN DESCRIBED SHALL BE COMPLETE IN EVERY DETAIL, EVEN THOUGH EVERY

# TYPICAL ELECTRICAL RECEPTACLES

| AREA | DESCRIPTION | MANUFACTURER |
|---|---|---|
| GENERAL | 20A DUPLEX, EXTRA HEAVY DUTY, TAMPER-RESISTANT, WHITE | HUBBELL #HBL5362STWTR |
| OUTDOOR | 20A DUPLEX, EXTRA HEAVY DUTY, TAMPER-RESISTANT, WEATHER-RESISTANT, GFCI, WHITE | HUBBELL #GFSG5362W |

NOTES:
1. COLORS AS LISTED IN TABLE ABOVE, UNLESS NOTED OTHERWISE
2. MANUFACTURER EQUALS BY LEVITON, PASS & SEYMOUR

# ELECTRICAL DEVICE TYPICAL MOUNTING HEIGHTS




NOTES:
1. INSTALL ELECTRICAL DEVICES AT MOUNTING HEIGHTS NOTED ABOVE UNLESS OTHERWISE NOTED ON PLANS. COORDINATE WITH ALL OTHER DISCIPLINES PRIOR TO INSTALL.
2. VISUAL MOUNTING APPLIANCE MOUNTING HEIGHT IN SLEEPING ROOMS:
   A. MINIMUM DISTANCE IN SLEEPING ROOMS IS 24" FROM CEILING TO THE TOP OF LENS FOR 110cd STROBES WITHIN 16' OF PILLOW
   B. 177cd STROBES, USED IN SLEEPING ROOMS, CAN BE WITHIN THE 24" MINIMUM DISTANCE FROM THE CEILING, THE HIGHER INTENSITY IS TO COMPENSATE FOR A POSSIBLE SMOKE LAYER

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| DATE | 03/21/2025 |
| SCALE | As indicated |
| ISSUED | |
| Project Status | |

ELECTRICAL SYMBOLS AND GENERAL NOTES

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# OF #

## SECTION 26 0010
## SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1. IT IS UNDERSTOOD AND AGREED BY THE INSTALLER THAT WORK HEREIN DESCRIBED SHALL BE COMPLETE IN EVERY DETAIL, EVEN THOUGH EVERY ITEM INVOLVED IS NOT PARTICULARLY MENTIONED. INSTALLER SHALL BE HELD TO PROVIDE ALL LABOR AND MATERIALS NECESSARY FOR THE WORK INTENDED AND DESCRIBED FOR A COMPLETE AND OPERATIONAL SYSTEM. SUCH MATERIALS SHALL INCLUDE, BUT ARE NOT LIMITED TO, CONDUIT, FITTINGS, COVERPLATES, WIRING, BREAKERS, CONTROL DEVICES, LIGHTING ACCESSORIES, ETC. THIS ALSO INCLUDES EQUIPMENT REQUIRED BY STATE AND LOCAL CODES.
2. CONTRACTOR TO PROCURE ALL REQUIRED BUILDING PERMITS AND INSPECTIONS TO COMPLETE PROJECT.
3. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE MICHIGAN ELECTRICAL CODE.
4. DO NOT INTERRUPT EXISTING ELECTRICAL SERVICE TO FACILITIES WITHOUT WRITTEN PERMISSION BY OWNER. COORDINATE WORK WITH EXISTING ELECTRICAL SERVICES WITH OWNER AND UTILITY COMPANY.
5. ARRANGE TO PROVIDE TEMPORARY ELECTRICAL SERVICE AS REQUIRED FOR SCOPE OF WORK.
6. PROVIDE NEW ELECTRICAL SERVICES FROM UTILITY COMPANY AS DIRECTED. COORDINATE SCOPE OF WORK AND PROVIDE ALL WORK TO PROVIDE A FULLY FUNCTIONAL ELECTRICAL SERVICE.
7. PROVIDE SHOP DRAWINGS FOR THE FOLLOWING:
   A. CONDUIT
   B. CONDUCTORS
   C. WIRING DEVICES, INCLUDING COVER PLATES
   D. DISCONNECT SWITCHES, ENCLOSED CIRCUIT BREAKERS AND FUSED SWITCHES
   E. PANELBOARDS AND SWITCHBOARDS
   F. SURGE PROTECTION DEVICES
   G. INTERIOR AND EXTERIOR LIGHTING FIXTURES, INCLUDING SITE POLES
   H. LIGHTING CONTROL SYSTEM AND DEVICES
   I. FIRE ALARM SYSTEM

PART 2 - EXECUTION

1. PROVIDE SCHEDULE FOR ELECTRICAL INSTALLATION WORK TO OWNER AND ARCHITECT FOR MAJOR MILESTONE DATES.
2. COORDINATION DRAWINGS; PROVIDE COORDINATION DRAWINGS FOR FOLLOWING INSTALLATIONS:
   A. LARGE INDOOR EQUIPMENT INSTALLATIONS.
   B. LARGE OUTDOOR EQUIPMENT INSTALLATIONS.
3. DEMOLITION WORK
   A. REMOVE ALL ELECTRICAL EQUIPMENT, WIRE, CONDUIT, ETC., ASSOCIATED WITH DEMOLISHED EQUIPMENT.
   B. REMOVE ALL ABANDONED ELECTRICAL CONDUIT AND WIRE BACK TO SOURCE.
   C. PATCH, REPAIR AND PAINT ANY OPENINGS THROUGH ROOF, CEILINGS, WALLS OR FLOORS TO MATCH EXISTING CONDITION. MAINTAIN ALL FIRE RATINGS OF WALLS AND DOORS.
   D. OWNER SHALL HAVE FIRST RIGHT OF REFUSAL OF ALL DEMOLISHED EQUIPMENT.
4. CLOSEOUT ACTIVITIES
   A. PROVIDE NORMAL OPERATION, EMERGENCY OPERATION AND PREVENTIVE MAINTENANCE MANUALS FOR EACH SYSTEM, EQUIPMENT AND DEVICE.
   B. PROVIDE SOFTWARE AND FIRMWARE OPERATION DOCUMENTATION FOR SYSTEM INSTALLED.
   C. PROVIDE BACKUP, UPGRADES AND UNRESTRICTED LICENSES FOR INSTALLED SOFTWARE, INCLUDING OPERATING SYSTEMS AND PROGRAMMING TOOLS REQUIRED FOR MAINTENANCE AND OPERATION.

## SECTION 26 0519
## LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL CONDUCTORS AND CABLES INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. COPPER BUILDING WIRE
   A. FLEXIBLE, INSULATED, DRAWN COPPER WITH AN INSULATION JACKET, RATED 600V OR LESS.
   B. PROVIDE THHN-2 COPPER INDOORS AND THWN-2 COPPER OUTDOORS, UNLESS NOTED OTHERWISE OR DICTATED OTHERWISE BY THE NEC.
   C. MINIMUM CONDUCTOR SIZE FOR POWER SHALL BE #12 AWG. ANY BRANCH CIRCUIT(S) OVER 100' IN LENGTH SHALL BE #10 AWG MINIMUM FOR VOLTAGE DROP.
   D. PROVIDE COLOR CODED WIRE WITH DIFFERENT COLOR FOR EACH PHASE, NEUTRAL AND GROUND, BASED ON ELECTRICAL SYSTEM TYPE.
2. CONNECTORS AND SPLICES
   A. FACTORY-FABRICATED CONNECTORS, SPLICES, AND LUGS OF SIZE, AMPACITY RATING, MATERIAL, TYPE, AND CLASS FOR APPLICATION AND SERVICE INDICATED.
   B. SHALL BE MARKED FOR INTENDED LOCATION AND USE.

PART 3 - EXECUTION

1. INSTALLATION
   A. CONCEAL CABLES IN FINISHED WALLS, CEILINGS AND FLOORS UNLESS OTHERWISE NOTED.
   B. USE PULLING MEANS, INCLUDING FISH TAPE, CABLE, ROPE, AND BASKET-WEAVE WIRE/CABLE GRIPS, THAT WILL NOT DAMAGE CABLES OR RACEWAY. USE MANUFACTURER APPROVED PULLING COMPOUND OR LUBRICANT WHEN NECESSARY.
   C. INSTALL CONDUCTORS AT EACH OUTLET, WITH AT LEAST 12" OF SLACK.
   D. ALL CABLING SHALL BE IN CONDUIT UNLESS ABOVE AN ACCESSIBLE CEILING WHERE "J" HOOKS ARE ACCEPTABLE.
2. CONNECTIONS
   A. TIGHTEN ELECTRICAL CONNECTORS AND TERMINALS ACCORDING TO MANUFACTURER'S PUBLISHED TORQUE-TIGHTENING VALUES.
   B. SPLICES, TERMINATIONS, AND TAPS SHALL BE COMPATIBLE WITH CONDUCTOR MATERIAL.
   C. CONDUCTORS SHALL BE CONTINUOUS FROM ORIGIN TO PANEL OR EQUIPMENT TERMINATION WHERE POSSIBLE. SPLICES AND TAPS, WHERE REQUIRED, SHALL BE MADE IN JUNCTION BOXES WITH SUITABLE CONNECTORS.
3. ACCEPTANCE
   A. ALL CONDUCTORS AND CONNECTIONS SHALL TEST FREE OF GROUNDS, SHORTS, AND OPENS PRIOR TO ENERGIZING CIRCUIT.

## SECTION 26 0526
## GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL GROUNDING AND BONDING PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. GROUNDING AND BONDING CONDUCTORS
   A. PROVIDE THHN/THWN-2, TINNED-COPPER WIRE OR CABLE, GREEN COLOR. CABLE SHALL BE RATED 600V.
2. GROUNDING AND BONDING CLAMPS
   A. CLAMPS SUITABLE FOR ATTACHMENT OF GROUNDING AND BONDING CONDUCTORS TO ELECTRODES, PIPES, TUBING, AND REBAR. SUITABLE TYPES SHALL BE:
      a. STRAP-TYPE PIPE AND ROD CLAMPS
      b. BEAM GROUNDING CLAMPS
      c. EXOTHERMICALLY WELDED CONNECTIONS
3. GROUNDING (EARTHING) ELECTRODES
   A. COPPER CLAD STEEL
   B. 3/4" DIAMETER BY 10' LENGTH

PART 3 - EXECUTION

1. PROVIDE GROUNDING ELECTRODE SYSTEM AND EQUIPMENT GROUNDING PER THE NATIONAL ELECTRIC CODE.
2. GROUNDING AND BONDING CONDUCTORS
   A. PROVIDE SOLID CONDUCTOR FOR 8 AWG AND SMALLER, AND STRANDED CONDUCTORS FOR 6 AWG AND LARGER, UNLESS OTHERWISE NOTED.
   B. ROUTE CONDUCTORS ALONG SHORTEST AND STRAIGHTEST PATHS POSSIBLE. AVOID OBSTRUCTING ACCESS TO OR PLACING CONDUCTORS WHERE THEY MAY BE SUBJECTED TO STRAIN, IMPACT, OR DAMAGE.
   C. PROVIDE GROUNDING AND BONDING BUSBARS IN ELECTRICAL EQUIPMENT ROOMS, ROOMS HOUSING SERVICE EQUIPMENT, AND ELSEWHERE INDICATED ON DRAWINGS.
3. CONNECTIONS
   A. MAKE CONNECTIONS SO POSSIBILITY OF GALVANIC ACTION OR ELECTROLYSIS IS MINIMIZED.
   B. USE EXOTHERMIC WELDS FOR ALL BELOW GRADE CONNECTIONS.
4. GROUNDING ELECTRODES
   A. DRIVE GROUND RODS UNTIL TOPS ARE 2" BELOW FINISHED FLOOR OR GRADE.
   B. INSTALL AT LEAST (3) RODS SPACED AT LEAST ONE-ROD LENGTH FROM EACH OTHER AND CONNECT TO SERVICE GROUNDING ELECTRODE CONDUCTOR.
   C. FOR CONCRETE-ENCASED ELECTRODE (UFER GROUND), USE MINIMUM 20' OF BARE COPPER CONDUCTOR NOT SMALLER THAN 4 AWG.
      a. IF FOUNDATION IS LESS THAN 20' LONG, COIL EXCESS CONDUCTOR WITHIN BASE OF FOUNDATION.
      b. BOND GROUNDING CONDUCTOR TO REINFORCING STEEL IN AT LEAST (4) LOCATIONS AND TO ANCHOR BOLTS. EXTEND GROUNDING CONDUCTOR BELOW GRADE AND CONNECT TO GROUNDING GRID OR GROUNDING ELECTRODE EXTERNAL TO CONCRETE.
5. EQUIPMENT GROUNDING AND BONDING
   A. INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS WITH THE FOLLOWING ITEMS:
      a. FEEDERS AND BRANCH CIRCUITS
      b. LIGHTING CIRCUITS
      c. RECEPTACLE CIRCUITS
      d. SINGLE, AND THREE-PHASE MOTOR AND APPLIANCE BRANCH CIRCUITS
      e. FLEXIBLE RACEWAY, ARMORED, AND METAL-CLAD CABLE RUNS
   B. ALL CORRUGATED STAINLESS STEEL TUBING FOR GAS PIPING SYSTEM IN KITCHENS SHALL BE BONDING TO THE GROUNDING ELECTRODE SYSTEM. BONDING JUMPER SHALL NOT BE SMALLER THAN 6 AWG.

## SECTION 26 0529
## HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL SUPPORT, ANCHORAGE, AND ATTACHMENT PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

A. STEEL HANGERS, CLAMPS, AND ASSOCIATED FITTINGS SHALL BE DESIGNED FOR TYPES AND SIZES OF RACEWAY OR CABLE TO BE SUPPORTED.
B. MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS FOR FASTENING ELECTRICAL ITEMS OR SUPPORTS TO BUILDING SURFACES:
   a. POWDER-ACTUATED FASTENERS
   b. MECHANICAL-EXPANSION ANCHORS
   c. CONCRETE INSERTS
   d. CLAMPS FOR ATTACHMENT TO STEEL STRUCTURAL ELEMENTS
   e. THROUGH BOLTS AND TOGGLE BOLTS
   f. HANGER RODS

PART 3 - EXECUTION

A. SUPPORT INSTALLATION
   a. PROVIDE SIZES OF COMPONENTS SO STRENGTH WILL BE ADEQUATE TO CARRY PRESENT AND FUTURE STATIC LOADS WITHIN SPECIFIED LIMITS.
   b. CUT, FIT, AND PLACE MISCELLANEOUS METAL SUPPORTS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION TO SUPPORT AND ANCHOR ELECTRICAL MATERIALS AND EQUIPMENT.
B. CONCRETE BASES
   a. ALL FLOOR MOUNT ELECTRICAL EQUIPMENT SHALL BE ON 4" HOUSEKEEPING PADS. PADS SHALL BE NOT LESS THAN 4" LARGER IN BOTH DIRECTIONS OF ELECTRICAL EQUIPMENT TO BE SUPPORTED.
C. TOUCHUP
   a. CLEAN WELDS AND ABRADED AREAS OF SHOP PAINT. PAINT EXPOSED AREAS IMMEDIATELY AFTER ERECTING HANGERS AND SUPPORTS.

## SECTION 26 0533.13
## CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL CONDUIT AND RACEWAY PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. ALL PRODUCTS SHALL BE UL LISTED AND LABELED.
2. EMT - RIGID, STEEL, ZINC-COATED (INTERIOR AND EXTERIOR).
3. RMC - RIGID, STEEL, ZINC-COATED (INTERIOR AND EXTERIOR).
4. FMC - FLEXIBLE, STEEL. PROVIDE AT TERMINATION POINT FOR EQUIPMENT SUBJECT TO MOTION AND VIBRATION.
5. MC CABLE - COLOR-CODED COPPER CONDUCTORS WITH INTERLOCKING GALVANIZED STEEL SHEATHING.
6. PVC - SCHEDULE 40, SCHEDULE 80, FOR USE WITH MAXIMUM 90 DEG C WIRE.
7. FITTINGS
   A. SHALL BE LISTED FOR USE WITH RACEWAY SYSTEM TO BE INSTALLED.

PART 3 - EXECUTION

1. CONDUIT TYPE SHALL BE SUITABLE FOR THE ENVIRONMENT IN WHICH IT IS LOCATED:
   A. INDOORS - EMT, AND/OR RMC, WITH SET-SCREW FITTINGS. MC CABLE IS ACCEPTABLE FOR BRANCH CIRCUITS WHERE CONCEALED.
   B. OUTDOORS - RIGID GALVANIZED STEEL.
   C. UNDERGROUND - RIGID, NON-METALLIC SCHEDULE 80 PVC.
      a. CONDUIT EXITING FROM UNDERGROUND SHALL TRANSITION TO EMT/RGS PRIOR TO BEING EXPOSED ABOVE GROUND.
2. MINIMUM CONDUIT SIZE SHALL BE 1/2" TRADE SIZE.
3. PROVIDE CONDUIT SLEEVES FOR LOW VOLTAGE DATA CABLING.
4. USE LARGE RADIUS ELLS FOR ALL CONDUIT BENDS.
5. CONDUITS SHALL BE CONCEALED WITHIN FINISHED WALLS, CEILINGS AND FLOORS UNLESS OTHERWISE INDICATED. CONDUITS SHALL BE SUPPORTED WITHIN 12" OF ENCLOSURES TO WHICH ATTACHED.
6. INSTALL RACEWAY SEALS AND FITTINGS AT ACCESSIBLE LOCATIONS.
7. DO NOT INSTALL CONDUITS WITHIN 2" OF THE BOTTOM SIDE OF METAL DECK ROOF.
8. KEEP CONDUITS AT LEAST 6" AWAY FROM PARALLEL RUNS OF FLUES AND STEAM OR HOT-WATER PIPES.
9. INSTALL PULL WIRES IN EMPTY RACEWAYS FOR FUTURE USE. PROVIDE POLYPROPYLENE OR MONOFILAMENT PLASTIC LINE WITH NOT LESS THAN 200lb TENSILE STRENGTH. LEAVE AT LEAST 12" OF SLACK AT BOTH ENDS OF CONDUIT.
10. CAP AND SEAL UNDERGROUND RACEWAYS DESIGNATED AS SPARE ABOVE GRADE ALONGSIDE DUCT RACEWAYS IN USE.
11. PROVIDE SEPARATE RACEWAY SYSTEM FOR EMERGENCY CIRCUIT(S). EMERGENCY CIRCUITS SHALL NOT BE IN CONDUIT WITH OTHER NON-EMERGENCY CIRCUITS.

## SECTION 26 0533.16
## BOXES AND COVERS ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL BOX AND COVER PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. METALLIC OUTLET BOXES
   A. LISTED AND LABELED FOR INTENDED LOCATION AND USE.
   B. MATERIAL SHALL BE SHEET METAL GALVANIZED STEEL, WITH A MINIMUM DEPTH OF 2.5".
   C. BOXES SHALL HAVE PRYOUT OPENINGS, KNOCKOUTS, THREADED ENTRIES, OR HUBS IN EITHER SIDES OR BACK FOR CONDUITS OR CONDUIT FITTINGS. SHALL HAVE PROVISIONS FOR MOUNTING OUTLET BOX COVER.
   D. EXTENSION RINGS SHALL BE PROVIDED WHERE REQUIRED OR INDICATED ON DRAWINGS, TO EXTEND DEVICE BOX TO INCREASE DEPTH. EXTENSION RINGS SHALL BE SUITABLE FOR USE WITH ASSOCIATED DEVICE BOX.
2. NONMETALLIC OUTLET BOXES
   A. LISTED AND LABELED FOR INTENDED LOCATION AND USE.
3. COVER PLATES
   A. LISTED AND LABELED FOR INTENDED LOCATION AND USE WITH ASSOCIATED OUTLET BOX TYPE.
   B. FOR USE IN FINISHED LOCATIONS: .032" THICK, TYPE 302/304 NON-MAGNETIC STAINLESS STEEL.
      a. ALL DEVICE COVERS SHALL BE BRUSHED STAINLESS STEEL, UNLESS SPECIFIC DEVICE COLOR IS SPECIFIED.
   C. PROVIDE GASKETS FOR WALLPLATES IN DAMP OR WET LOCATIONS.
   D. WEATHERPROOF COVERS
      a. SHALL BE METAL, "WHILE-IN-USE" TYPE. COVER SHALL BE GRAY COLOR.

PART 3 - EXECUTION

1. ALL BOXES SHALL BE RECESSED IN WALLS AND CONDUIT CONCEALED WHERE POSSIBLE.
   A. CUT, PATCH, REPAIR AND PAINT GYPSUM AND/OR MASONRY WALLS TO RECESS NEW BOXES WHERE INDICATED.
   B. HORIZONTALLY SEPARATE BOXES MOUNTED ON OPPOSITE SIDES OF WALLS SO THEY ARE NOT IN THE SAME VERTICAL CHANNEL.
2. PROVIDE NEMA 1 BOXES AND COVERS FOR INDOOR LOCATIONS, UNLESS OTHERWISE NOTED.
3. PROVIDE NEMA 3R BOXES AND COVERS FOR OUTDOOR LOCATIONS, UNLESS OTHERWISE NOTED.
4. SUPPORT
   A. SUPPORT BOXES IN RECESSED CEILINGS INDEPENDENT OF CEILING TILES OR GRID.
   B. SUPPORT JUNCTION OR PULL BOXES FROM BUILDING STRUCTURE. DO NOT SUPPORT BOXES BY CONDUIT(S).
5. ALL BOXES USED FOR LOW VOLTAGE DATA CABLING SHALL BE DOUBLE GANG, 3-1/2" DEEP WITH SINGLE GANG MUD RING. PROVIDE 1" CONDUIT TO ABOVE ACCESSIBLE CEILING FOR DATA CABLING.

## SECTION 26 0553
## IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL LABEL AND IDENTIFICATION PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. LABELS
   A. LISTED AND LABELED FOR INTENDED LOCATION AND APPLICATION.
   B. VINYL WRAPAROUND LABELS - PREPRINTED, FLEXIBLE LABELS LAMINATED WITH CLEAR, WEATHER AND CHEMICAL-RESISTANT COATING.
   C. SELF-ADHESIVE WRAPAROUND LABELS - PREPRINTED, VINYL FLEXIBLE LABEL WITH ACRYLIC PRESSURE-SENSITIVE ADHESIVE.
   D. SELF-ADHESIVE LABELS - POLYESTER VINYL, THERMAL, TRANSFER PRINTED, MULTI-COLOR, WEATHER AND UV-RESISTANT, PRESSURE-SENSITIVE ADHESIVE.
   E. SIZE
      a. 1-1/2" BY 6" FOR RACEWAYS AND CONDUCTORS.
      b. 3-1/2" BY 5" FOR EQUIPMENT.
2. SIGNS
   A. LAMINATED ACRYLIC OR MELAMINE PLASTIC.
      a. 1/16" THICK FOR SIGNS UP TO 20 SQ. IN.
      b. 1/8" THICK FOR SIGNS GREATER THAN 20 SQ. IN.
      c. ENGRAVED LEGEND WITH BLACK LETTERS ON WHITE FACE.
      d. PUNCHED OR DRILLED FOR MECHANICAL FASTENERS WITH 1/4" GROMMETS IN CORNERS FOR MOUNTING.
3. UNDERGROUND-LINE WARNING TAPE
   A. SUITABLE TO IDENTIFY AND LOCATE UNDERGROUND ELECTRICAL AND COMMUNICATIONS UTILITY LINES.
   B. PRINTING ON TAPE MUST BE PERMANENT AND NOT DAMAGED BY BURIAL OPERATIONS.
   C. INSCRIPTIONS SHALL READ "CAUTION BURIED ELECTRIC LINE BELOW" OR "CAUTION BURIED COMMUNICATION LINE BELOW".
   D. DETECTABLE WARNING TAPE
      a. REINFORCED, DETECTABLE THREE-LAYER LAMINATE, CONSISTING OF ALUMINUM-FOIL CORE AND CLEAR PROTECTIVE FILM.

PART 3 - EXECUTION

1. PROVIDE BAKED ENAMEL SIGNS FOR:
   A. PANELBOARDS AND SWITCHBOARDS
   B. TRANSFORMERS
   C. DISCONNECT SWITCHES
   D. VARIABLE FREQUENCY DRIVES
   E. LIGHTING CONTROL PANELS. LABELS SHALL INDICATED ROOMS CONTROLLED
2. IDENTIFY CONDUCTORS, CABLES, AND TERMINALS IN ENCLOSURES AND AT JUNCTIONS, TERMINALS, PULL POINTS, AND LOCATIONS OF HIGH VISIBILITY. IDENTIFY BY SYSTEM AND CIRCUIT DESIGNATION.
3. PROVIDE UNDERGROUND-LINE WARNING TAPE FOR POWER, LIGHTING, AND COMMUNICATIONS CABLING.
4. LABEL INDIVIDUAL COVER PLATES WITH SELF-ADHESIVE LABELS. LABEL TO INDICATE CIRCUIT WHICH DEVICE IS FED FROM WITH THE FOLLOWING INFORMATION:
   A. PANELBOARD DESIGNATION - BRANCH CIRCUIT NUMBER.
5. INSTALL IDENTIFICATION MATERIALS AT LOCATIONS FOR MOST CONVENIENT VIEWING WITHOUT INTERFERENCE WITH OPERATION AND MAINTENANCE OF EQUIPMENT.
6. PROVIDE FLOOR MARKING TAPE TO INDICATE WORKING CLEARANCE OF ELECTRICAL EQUIPMENT. FLOOR MARKING TAPE SHALL NOT BE USED FOR SURFACE OR FLUSH-MOUNTED PANELBOARDS AND SIMILAR EQUIPMENT IN FINISHED SPACES.

## SECTION 26 0923
## LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL LIGHTING CONTROL PRODUCTS INSTALLED DURING COURSE OF WORK.
   A. PROVIDE SUBMITTALS THAT INCLUDE INTERCONNECTION DIAGRAMS AND DIAGRAMS FOR POWER, SIGNAL, AND CONTROL WIRING.

PART 2 - PRODUCTS

1. ELECTROMECHANICAL DIAL-TIME SWITCHES
   A. MANUFACTURER
      a. INTERMATIC, INC.
      b. LEVITON MANUFACTURING CO., INC.
      c. NSI INDUSTRIES LLC
   B. ASTRONOMICAL TIME DIAL.
   C. SPST CONTACT, RATED FOR 20A BALLAST LOAD, 120/240 VAC.
   D. ALLOW FOR CONNECTION OF A PHOTOELECTRIC RELAY AS A SUBSTITUTE FOR ON/OFF FUNCTION OF A PROGRAM.
   E. EIGHT-DAY PROGRAM - UNIQUELY PROGRAMMABLE FOR EACH WEEKDAY OR HOLIDAY.
2. INDOOR OCCUPANCY AND VACANCY SENSORS
   A. MANUFACTURER
      a. N-LIGHT, UNLESS NOTED OTHERWISE.
   B. WALL OR CEILING MOUNTED.
   C. DUAL TECHNOLOGY, SEPARATE POWER PACK.
   D. OCCUPANCY MODE - TURN LIGHTS ON WHEN AREA IS OCCUPIED AND OFF WHEN UNOCCUPIED. PROVIDE TIME DELAY FOR TURNING LIGHTS OFF WITH ADJUSTABLE RANGE OF 1 TO 15 MINUTES.
   E. VACANCY MODE - LIGHTS TO BE TURNED ON MANUALLY AND SENSOR TO TURN LIGHTS OFF WHEN AREA IS UNOCCUPIED. PROVIDE TIME DELAY FOR TURNING LIGHTS OFF WITH ADJUSTABLE RANGE OF 1 TO 15 MINUTES.
   F. POWER PACK - LINE VOLTAGE. DRY CONTACTS RATED FOR A 20A LED LOAD AT 120VAC AND 277VAC. POWER PACK TO CONTAIN AUXILIARY DRY CONTACT FOR SPARE CONNECTION TO OTHER BUILDING SYSTEM(S).
3. SWITCHBOX-MOUNTED OCCUPANCY SENSORS
   A. MANUFACTURER
      a. N-LIGHT, UNLESS OTHERWISE NOTED.
   B. OPERATION - TURN LIGHTS ON WHEN AREA IS OCCUPIED AND OFF WHEN UNOCCUPIED. PROVIDE TIME DELAY FOR TURNING LIGHTS OFF WITH ADJUSTABLE RANGE OF 1 TO 15 MINUTES.
   C. SWITCH RATING - NOT LESS THAN 800 VA LED LOAD AT 120 VAC, 1200 VA LED LOAD AT 277 VAC, AND 800 W INCANDESCENT.
   D. SENSOR TECHNOLOGY - DUAL TECHNOLOGY - PIR AND ULTRASONIC.
   E. VOLTAGE TO MATCH THE CIRCUIT VOLTAGE.
   F. COLOR TO MATCH WIRING DEVICE FINISHES. FACEPLATE FINISH TO BE BRUSHED STAINLESS STEEL, UNLESS OTHERWISE INDICATED.

PART 3 - EXECUTION

1. INSTALLATION
   A. ALL LIGHTING CONTROLS SHALL MEET ASHRAE 90.1 - 2013, WITH MICHIGAN AMENDMENTS.
   B. COORDINATE LAYOUT AND INSTALLATION OF CEILING-MOUNTED DEVICES WITH OTHER BUILDING SYSTEMS THAT PENETRATE CEILINGS.
   C. INSTALL AND AIM SENSORS IN LOCATIONS TO ACHIEVE NOT LESS THAN 90% COVERAGE OF AREAS INDICATED.
   D. MOUNT ELECTRICALLY HELD LIGHTING CONTACTORS WITH ELASTOMER ISOLATOR PADS TO ELIMINATE VIBRATION.
   E. SIZE CONDUCTORS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
   F. ALL EXPOSED WIRING AREAS SHALL BE INSTALLED IN CONDUIT. NO EXPOSED LOW VOLTAGE WIRING WILL BE ALLOWED.
2. IDENTIFICATION
   A. IDENTIFY CONTROLLED CIRCUITS IN LIGHTING CONTRACTORS.
   B. IDENTIFY CIRCUITS OR LUMINAIRES CONTROLLED BY PHOTOELECTRIC AND OCCUPANCY SENSORS AT EACH SENSOR.

Infrastructure Planning and Facilities
MICHIGAN STATE UNIVERSITY

MANLY MILES
AIR COOLED CHILLER

MSU PROJ. NO.
24.214

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| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

ELECTRICAL SPECIFICATIONS

E001

# OF #

## SECTION 26 2416
## PANELBOARDS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL PANELBOARD PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. MANUFACTURER
   A. SQUARE D - NQOD FOR 208/120V BRANCH PANELBOARDS, NF FOR 480/277V BRANCH PANELBOARDS.
   B. OR EQUAL BY:
      a. EATON CORP.
      b. SIEMENS
2. ELECTRICAL COMPONENTS, DEVICES, AND EQUIPMENT SHALL BE UL LABELED.
3. ENCLOSURES
   A. RATED FOR ENVIRONMENTAL CONDITIONS AT INSTALLED LOCATION
      a. INDOOR, DRY AND CLEAN LOCATIONS - NEMA 1
      b. OUTDOOR LOCATIONS - NEMA 3R
      c. KITCHEN LOCATIONS - NEMA 4X, STAINLESS STEEL
      d. OTHER WET AND DAMP INDOOR LOCATIONS - NEMA 4
   B. FRONT - SECURE TO BOX WITH CONCEALED TRIM CLAMPS. FOR SURFACE-MOUNTED FRONTS, MATCH DIMENSIONS; FOR FLUSH-MOUNTED FRONTS, OVERLAP BOX. TRIMS MUST COVER LIVE PARTS AND MAY HAVE NO EXPOSED HARDWARE.
4. BUSES
   A. TIN-PLATED ALUMINUM FOR 400A OR LESS.
   B. HARD DRAWN COPPER FOR ABOVE 400A.
5. CONDUCTOR CONNECTORS
   A. TIN-PLATED ALUMINUM OR HARD DRAWN COPPER, 98% CONDUCTIVITY.
   B. MAIN AND NEUTRAL LUGS - MECHANICAL TYPE, WITH LUG ON NEUTRAL BAR FOR EACH POLE IN PANELBOARD.
   C. GROUND LUGS AND BUS-CONFIGURED TERMINATORS - MECHANICAL TYPE, WITH LUG ON BAR FOR EACH POLE IN PANELBOARD.
   D. SUBFEED LUGS - MECHANICAL TYPE, SUITABLE FOR USE WITH CONDUCTOR MATERIAL. LOCATE AT SAME END OF BUS AS INCOMING LUGS OR MAIN DEVICE.
6. SHORT-CIRCUIT CURRENT RATING
   A. FULLY RATED TO INTERRUPT SYMMETRICAL SHORT-CIRCUIT CURRENT AVAILABLE AT TERMINALS. SERIES RATED PANELS ARE NOT ACCEPTABLE.
7. OVERCURRENT PROTECTIVE DEVICES
   A. THERMAL-MAGNETIC CIRCUIT BREAKERS
      a. INVERSE TIME CURRENT ELEMENT FOR LOW-LEVEL OVERLOADS.
      b. INSTANTANEOUS MAGNETIC TRIP ELEMENT FOR SHORT CIRCUITS.
      c. ADJUSTABLE MAGNETIC TRIP SETTING FOR CIRCUIT-BREAKER FRAME SIZES 250A AND LARGER.
   B. ELECTRONIC TRIP CIRCUIT BREAKERS
      a. RMS SENSING.
      b. FIELD-REPLACEABLE RATING PLUG OR ELECTRONIC TRIP.
      c. FIELD ADJUSTABLE SETTINGS FOR: INSTANTANEOUS TRIP, LONG AND SHORT TIME PICKUP LEVELS, LONG AND SHORT TIME ADJUSTMENTS, AND GROUND FAULT PICKUP LEVEL, TIME DELAY AND $I^2T$ RESPONSE.
   C. SUBFEED CIRCUIT BREAKERS SHALL BE VERTICALLY ARRANGED ON PHASE BUSBARS.

PART 3 - EXECUTION

1. INSTALLATION
   A. MOUNT TOP OF PANELBOARD TRIP 7.5' ABOVE FINISHED FLOOR UNLESS OTHERWISE INDICATED.
   B. MOUNT PANELBOARD CABINET PLUMB AND RIGID WITHOUT DISTORTION OF BOX.
   C. MOUNT RECESSED PANELBOARDS WITH FRONT UNIFORMLY FLUSH WITH WALL FINISH.
      a. FOR RECESSED PANELBOARDS, STUB (4) 1" EMPTY CONDUITS FROM PANELBOARD INTO ACCESSIBLE CEILING SPACE OR SPACE DESIGNATED TO BE CEILING SPACE IN FUTURE.
   D. MAKE GROUNDING CONNECTIONS AND BOND NEUTRAL FOR SERVICES AND SEPARATELY DERIVED SYSTEMS TO GROUND. MAKE CONNECTIONS TO GROUNDING ELECTRODES, SEPARATE GROUNDS FOR ISOLATED GROUND BARS, AND CONNECTIONS TO SEPARATE GROUND BARS.
2. IDENTIFICATION
   A. PANELBOARD LABEL MUST LIST MANUFACTURER NAME, TRADEMARK, VOLTAGE, AMPERAGE, NUMBER OF PHASES, AND NUMBER OF POLES AND MUST BE LOCATED ON INTERIOR OF PANELBOARD DOOR.
   B. CIRCUIT BREAKER LABELS MUST LIST CURRENT RATING, UL AND IEC CERTIFICATION STANDARDS, AND AIC RATING.
   C. CIRCUIT DIRECTORY
      a. PROVIDE CIRCUIT DIRECTORY CARD INSIDE PANELBOARD DOOR, MOUNTED IN TRANSPARENT CARD HOLDER.
      b. PANELBOARD DIRECTORY SHALL BE TYPE-WRITTEN, AND PROVIDE DETAILED INFORMATION SHOWN ON ASSOCIATED PANELBOARD LOAD SCHEDULE.
      c. UPDATE ALL EXISTING CIRCUIT DIRECTORY CARDS AS REQUIRED.

## SECTION 26 2726
## WIRING DEVICES

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL WIRING DEVICE PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. GENERAL USE SWITCHES
   A. MANUFACTURER
      a. ARROW HART, WIRING DEVICES
      b. HUBBELL WIRING DEVICE-KELLEMS, HUBBELL, INC.
      c. LEVITON MANUFACTURING CO., INC.
      d. PASS & SEYMOUR, LEGRAND NORTH AMERICA, LLC
   B. GENERAL CHARACTERISTICS
      a. HEAVY DUTY GRADE, QUIET TYPE, 120/277 VAC, RATED 20A MINIMUM.
      b. COLOR - WHITE, UNLESS OTHERWISE INDICATED.
      c. PROVIDE BRUSHED STAINLESS STEEL COVER DESIGNED FOR USE WITH DEVICE, UNLESS OTHERWISE INDICATED.
2. STRAIGHT-BLADE RECEPTACLES
   A. MANUFACTURER
      a. HUBBELL WIRING DEVICE-KELLEMS, HUBBELL, INC.
   B. GENERAL CHARACTERISTICS
      a. EXTRA HEAVY DUTY GRADE, TAMPER-RESISTANT, RATED 20A MINIMUM.
      b. COLOR - WHITE, UNLESS OTHERWISE INDICATED.
      c. PROVIDE BRUSHED STAINLESS STEEL COVER DESIGNED FOR USE WITH DEVICE, UNLESS OTHERWISE INDICATED.

PART 3 - EXECUTION

1. INSTALLATION
   A. UNLESS OTHERWISE INDICATED, INSTALL SWITCHES, RECEPTACLES, AND OTHER WIRING DEVICES, AT MOUNTING HEIGHTS RECOMMENDED IN NECA NEIS 1.
   B. ORIENT RECEPTACLES TO MATCH CONFIGURATION DIAGRAM IN NEMA WD 6.
      a. RECEPTACLES ORIENTED HORIZONTALLY SHALL BE MOUNTED WITH NEUTRAL BLADE FACING UP.
2. IDENTIFICATION
   A. MARK INSIDE OF COVER OR COVER PLATE OF WIRING DEVICE(S) WITH PANELBOARD AND CIRCUIT NUMBER FEEDING WIRING DEVICE(S).

## SECTION 26 4313
## SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL SURGE PROTECTIVE DEVICE PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. MANUFACTURER
   A. RAYCAP
      a. TYPE 1, SERVICE ENTRANCE - RAYVOSS
      b. TYPE 2, BRANCH PANEL - RSE2
2. GENERAL CHARACTERISTICS
   A. MCOV: NOT LESS THAN 125% OF NOMINAL SYSTEM VOLTAGE FOR 208Y/120V AND 120/240V SYSTEMS. NOT LESS THAN 115% OF NOMINAL SYSTEM VOLTAGE FOR 480Y/277V SYSTEMS.
   B. PEAK SURGE CURRENT RATING: MINIMUM SINGLE-PULSE SURGE CURRENT WITHSTAND RATING PER PHASE SHALL BE NOT LESS THAN -
      a. TYPE 1: 160, OR 240 kA.
      b. TYPE 2: 50, 100, 150, OR 200 kA.
   C. PROTECTION MODES: DEVICE SHALL HAVE PROTECTION MODES FOR LINE-TO-NEUTRAL, AND LINE-TO-LINE, FOR TYPE 1 DEVICES, AND LINE-TO-NEUTRAL, LINE-TO-GROUND, NEUTRAL-TO-GROUND, AND LINE-TO-LINE, FOR TYPE 2 DEVICES.
3. OPTIONS
   A. INTERNAL THERMAL PROTECTION TO DISCONNECT SPD BEFORE DAMAGING INTERNAL SUPPRESSOR COMPONENTS.
   B. INDICATOR LIGHT DISPLAY FOR PROTECTION STATUS.
   C. AUDIBLE ALARM.
   D. NEMA ICS 5, DRY FORM-C CONTACTS RATED AT 1 A AND 120 VAC FOR REMOTE MONITORING OF PROTECTION STATUS.
   E. TYPE 2 DEVICES: TOV AND SURGE COUNTER WITH TIME AND DATE STAMP.

PART 3 - EXECUTION

1. INSTALLATION
   A. PROVIDE OCPD AND DISCONNECT FOR INSTALLATION OF SPD IN ACCORDANCE WITH UL 1449 AND MANUFACTURER INSTRUCTIONS.
   B. INSTALL LEADS BETWEEN DISCONNECT(S) AND SPD(S) IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.
      a. DO NOT SPLICE AND EXTEND SPD LEADS UNLESS PERMITTED BY MANUFACTURER.
      b. DO NOT EXCEED MANUFACTURER RECOMMENDED LEAD LENGTH.
      c. DO NOT BOND NEUTRAL AND GROUND.
      d. USE CRIMPED CONNECTORS AND SPLICES ONLY. WIRE NUTS ARE NOT ACCEPTABLE.
   C. SURGE PROTECTION DEVICES SHALL BE MOUNTED AS CLOSE TO MAIN BUS AS POSSIBLE TO LIMIT FEEDER LENGTH.

## SECTION 26 5119
## LED LIGHTING

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL LED LIGHTING PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. GENERAL CHARACTERISTICS
   A. PROVIDE ALL INTERIOR AND EXTERIOR LUMINAIRES AS INDICATED ON THE LIGHT FIXTURE SCHEDULE.
   B. ELECTRICAL COMPONENTS, DEVICES AND ACCESSORIES SHALL BE LISTED AND LABELED AS DEFINED IN NFPA 70, BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION.
   C. METAL PARTS SHALL BE FREE OF BURRS AND SHARP CORNERS AND EDGES. SHEET METAL COMPONENTS SHALL BE STEEL UNLESS OTHERWISE INDICATED. FORM AND SUPPORT SHALL PREVENT WARPING AND SAGGING.
   D. LUMINAIRE FINISHES SHALL BE FACTORY APPLIED AND RATED FOR THE INTENDED LOCATION AND APPLICATION.
   E. LUMINAIRE SUPPORT
      a. SINGLE-STEM HANGARS: 1/2" STEEL TUBING WITH SWIVEL BALL FITTINGS AND CEILING CANOPY. FINISH SAME AS LUMINAIRE.
      b. WIRES: 12 GAUGE, CLASS 3, SOFT TEMPER, ZINC-COATED STEEL.
      c. ROD HANGERS: 3/16" MINIMUM DIAMETER, CADMIUM-PLATED, THREADED STEEL ROD.
      d. HOOK HANGERS: INTEGRATED ASSEMBLY MATCHED TO LUMINAIRE.
      e. JUNCTION BOX CANOPY COVERS SHALL MATCH COLOR OF THE CEILING THEY ARE ATTACHED TO.
      f. CONCRETE BASES SHALL BE PROVIDED FOR ALL POLE MOUNTED LUMINAIRES. CONDUIT(S) SHALL BE CAST INTO BASE.
   F. INTEGRAL EMERGENCY BATTERY PACKS
      a. WHERE SPECIFIED, BATTERY PACKS SHALL PROVIDE MINIMUM 90 MINUTES OF LIGHT AT RATED OUTPUT OF BATTERY PACK.

PART 3 - EXECUTION

1. INSTALLATION
   A. LUMINAIRES SHALL BE INSTALLED LEVEL, PLUMB, AND SQUARE WITH CEILINGS AND WALLS UNLESS OTHERWISE INDICATED.
   B. LUMINAIRE SUPPORTS SHALL BE SIZED AND RATED FOR LUMINAIRE WEIGHT WITHOUT CAUSING DEFLECTION OF CEILING OR WALL.
   C. INSTALL ACCESSORIES FURNISHED WITH EACH LUMINAIRE.
   D. AIM DIRECTIONAL LUMINAIRES AS INDICATED ON DRAWINGS.
2. IDENTIFICATION
   A. JUNCTION BOXES SERVING BRANCH CIRCUIT WIRING FOR LUMINAIRES SHALL BE LABELED WITH ASSOCIATED PANELBOARD AND CIRCUIT NUMBER.

## SECTION 28 4621
## ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1. PROVIDE SHOP DRAWING SUBMITTALS FOR ALL FIRE ALARM SYSTEM PRODUCTS INSTALLED DURING COURSE OF WORK.

PART 2 - PRODUCTS

1. GENERAL CHARACTERISTICS
   A. FINISHED SYSTEM SHALL BE NON-CODED, UL-CERTIFIED ADDRESSABLE SYSTEM, WITH MULTIPLEXED SIGNAL TRANSMISSION AND VOICE AND STROBE NOTIFICATION FOR EVACUATION. SYSTEM SHALL BE FIELD PROGRAMMABLE, MICROPROCESSOR-BASED, AND MODULAR.
   B. FIRE ALARM COMPONENTS, DEVICES, AND ACCESSORIES SHALL BE LISTED AND LABELED BY AN NRTL IN ACCORDANCE WITH NFPA 70 FOR USE WITH SELECTED FIRE-ALARM SYSTEM AND MARKED FOR INTENDED LOCATION AND APPLICATION.
   C. FIRE-ALARM SIGNAL INITIATION MUST BE BY ONE OF THE FOLLOWING DEVICES AND/OR SYSTEMS:
      a. MANUAL PULL STATIONS
      b. DETECTORS: HEAT, FLAME, SMOKE, DUCT, CARBON MONOXIDE, ETC.
      c. AUTOMATIC SPRINKLER SYSTEM WATER FLOW
      d. PREACTION SYSTEM
      e. DRY-TYPE SYSTEM PRESSURE FLOW SWITCH
      f. FIRE PUMP OR FIRE STANDPIPE SYSTEM
   D. FIRE ALARM SIGNAL INITIATION MUST INITIATE THE FOLLOWING:
      a. CONTINUOUSLY OPERATE ALARM NOTIFICATION APPLIANCES, INCLUDING VOICE EVACUATION NOTICES
      b. IDENTIFY ALARM AND SPECIFIC INITIATING DEVICE AT FACU, CONNECTED NETWORK CONTROL PANELS, REMOTE ANNUNCIATORS, AND OFF-PREMISES NETWORK CONTROL PANELS
      c. TRANSMIT ALARM SIGNAL TO REMOTE ALARM RECEIVING STATION
      d. UNLOCK ELECTRIC DOOR LOCKS IN DESIGNATED EGRESS PATHS
      e. RELEASE FIRE AND SMOKE DOORS HELD OPEN BY MAGNETIC DOOR HOLDERS
      f. ACTIVATE VOICE/ALARM COMMUNICATION SYSTEM
      g. SWITCH HVAC EQUIPMENT CONTROLS TO FIRE-ALARM MODE
      h. ACTIVE SMOKE CONTROL SYSTEM AT FIRE FIGHTERS SMOKE CONTROL STATION (WHERE APPLICABLE)
      i. CLOSE SMOKE DAMPERS IN AIR DUCTS OF DESIGNATED HVAC DUCT SYSTEMS
      j. RECALL ELEVATOR(S) TO PRIMARY OR ALTERNATE RECALL FLOORS
      k. ACTIVATE EMERGENCY LIGHTING CONTROL
      l. ACTIVATE EMERGENCY SHUTOFFS FOR GAS AND FUEL SUPPLIES, EXCEPT FOR SHUTOFFS SERVING LEGALLY REQUIRED LIFE SAFETY SYSTEMS SUCH AS EMERGENCY GENERATORS AND FIRE PUMPS
      m. RECORD EVENTS IN SYSTEM MEMORY
   E. PROVIDE NETWORK COMMUNICATIONS IN ACCORDANCE WITH MANUFACTURER WRITTEN INSTRUCTIONS.
   F. DEVICE GUARDS SHALL BE WELDED WIRE MESH OF SIZE AND SHAPE REQUIRED FOR PROTECTED DEVICE. PAINT COLOR SHALL MATCH PROTECTED DEVICE.

PART 3 - EXECUTION

1. INSTALLATION
   A. IF APPLICABLE, VERIFY FUNCTIONALITY OF INSTALLED COMPONENTS OF EXISTING SYSTEM PRIOR TO STARTING WORK. DOCUMENT EQUIPMENT OR COMPONENTS NOT FUNCTIONING AS DESIGNED.
      a. DO NOT INTERRUPT FIRE-ALARM SERVICE TO FACILITIES OCCUPIED BY OWNER OR OTHERS UNLESS PERMITTED WITH CONSTRUCTION MANAGERS WRITTEN PERMISSION. NOTIFY CONSTRUCTION MANAGER NO FEWER THAN (7) DAYS IN ADVANCE OF PROPOSED INTERRUPTION OF FIRE-ALARM SERVICE.
      b. CONNECT NEW EQUIPMENT TO EXISTING CONTROL PANEL, OR MONITORING EQUIPMENT AT SUPERVISING STATION.
      c. EXPAND, MODIFY, AND SUPPLEMENT EXISTING CONTROL EQUIPMENT AS NECESSARY TO EXTEND CONTROL FUNCTIONS TO NEW POINTS. NEW COMPONENTS MUST BE CAPABLE OF MERGING WITH EXISTING CONFIGURATION WITHOUT DEGRADING PERFORMANCE OF EITHER SYSTEM.
   B. INSTALL WALL MOUNTED EQUIPMENT WITH TOPS OF CABINETS NOT MORE THAN 78" ABOVE FINISHED FLOOR.
   C. INSTALL MANUAL FIRE-ALARM BOXES IN NORMAL PATH OF EGRESS WITHIN 60" OF EXIT DOORWAY. MANUAL BOXES MUST BE INSTALLED ON BACKGROUND OF CONTRASTING COLOR. OPERABLE PART OF MANUAL BOXES MUST BE BETWEEN 42" AND 48" ABOVE FINISHED FLOOR.
   D. INSTALL DETECTORS WITH SPACING AS REQUIRED BY NFPA 72. DUCT DETECTORS SHALL HAVE SAMPLING TUBES THAT EXTEND FULL WIDTH OF DUCT.
   E. EXPOSED PATHWAYS LOCATED LESS THAN 96" ABOVE FINISHED FLOOR MUST BE INSTALLED IN EMT. EXPOSED EMT MUST BE PAINTED RED.
2. IDENTIFICATION
   A. INSTALL NAMEPLATE FOR EACH ELECTRICAL CONNECTION, INDICATING ELECTRICAL EQUIPMENT DESIGNATION AND CIRCUIT NUMBER FEEDING CONNECTION.
   B. INSTALL FRAMED INSTRUCTIONS IN LOCATION VISIBLE FROM FACU.
   C. IDENTIFY SYSTEM COMPONENTS, WIRING, CABLING, AND TERMINALS.

Infrastructure Planning and Facilities
MICHIGAN STATE UNIVERSITY

MANLY MILES
AIR COOLED CHILLER

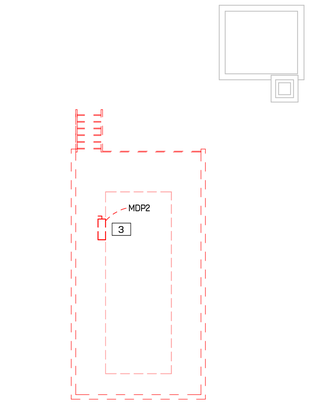
MSU PROJ. NO.
24.214

| | |
|---|---|
| PR. MGR. | MANGLES |
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

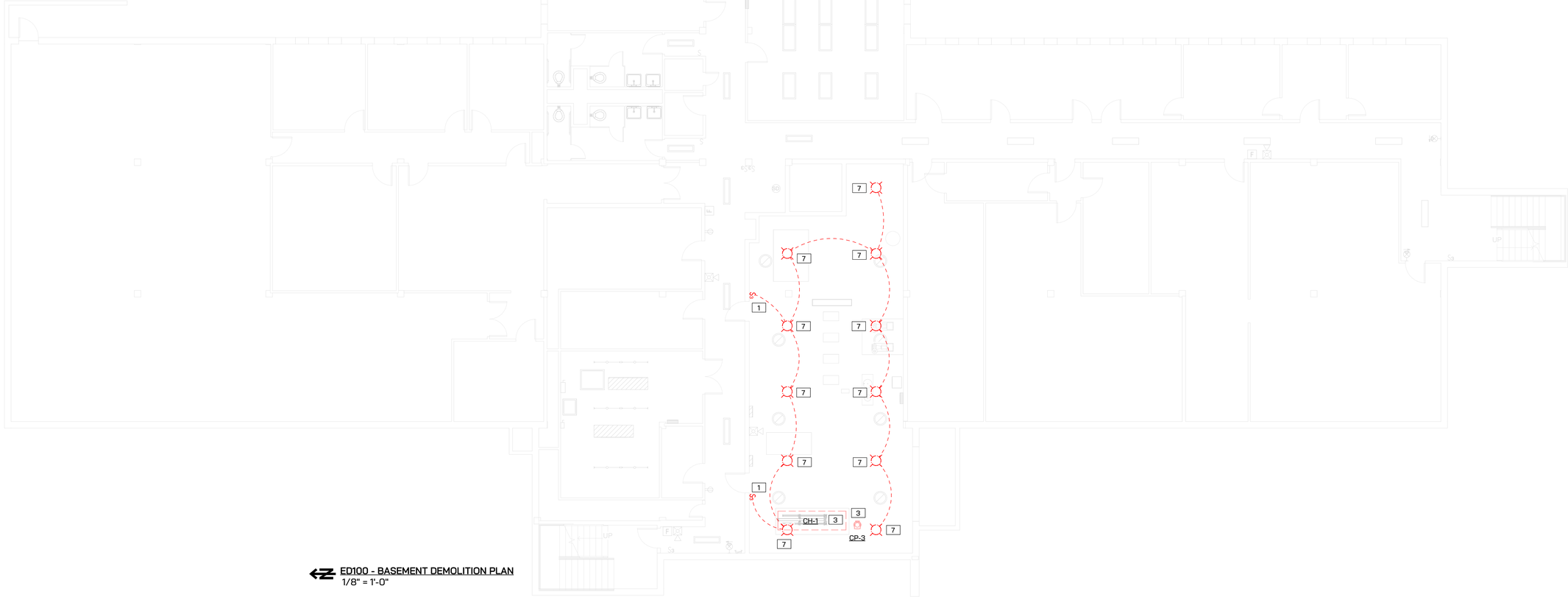
ELECTRICAL SPECIFICATIONS

E002

# OF #




PARTIAL ROOF MECHANICAL DEMOLITION PLAN
1/8" = 1'-0"




ED100 - BASEMENT DEMOLITION PLAN
1/8" = 1'-0"

## ELECTRICAL DEMOLITION KEYED NOTES

1 REPLACE SWITCH AND COVER PLATE WITH NEW. RECONNECT TO EXISTING CIRCUIT AND LOAD SIDE WIRING.

2 REMOVE LIGHT FIXTURE, RETAIN WIRING FOR USE WITH NEW. EXTEND AS REQUIRED.

3 REMOVE EXISTING ELECTRICAL CONNECTION TO MECHANICAL UNIT. REMOVE ALL DISCONNECTS, STARTERS AND ASSOCIATED CONDUIT AND FEEDER BACK TO OVERCURRENT PROTECTION DEVICE.

7 REMOVE LIGHT FIXTURE AND ALL ASSOCIATED CONDUIT AND WIRE BACK TO SWITCH.

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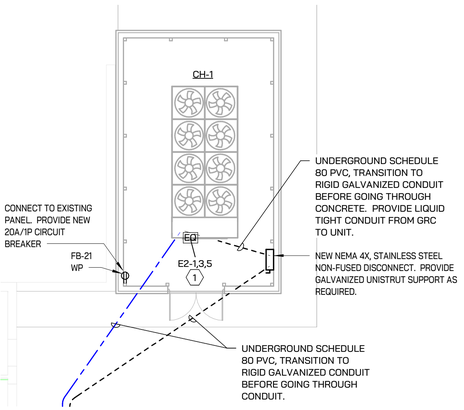
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

BASEMENT AND ROOF ELECTRICAL DEMOLITION PLAN

ED100

# OF #




OUTDOOR POWER PLAN
1/8" = 1'-0"

REFER TO OUTDOOR POWER PLAN FOR CONTINUATION

ALL UNDERGROUND CONDUIT SHALL BWE SCHED 80 PVC AND TRANSITION TO RGC PRIOR TO TRANSITIONAING THROUGH CONCRETE SLAB. FINAL CONNECTION TO CHILLER SHALL TRANSITION TO FLEXIBLE WEATHER TIGHT CONDUIT.

SPACE
B15

G
FB
A

PROVIDE JUNCTION BOX AS REQUIRED FOR NEW FEEDER TO NEW OUTDOOR EQUIPMENT.

COORDINATE NEW CONDUIT ROUTE WITH NEW PIPING. UTILIZE SAME RACKING IF POSSIBLE.

RUN COMMUNICATIONS CONDUIT TO BMS PANEL

1
BP-13,15,17
VFD
EQ
CHWP-3 (Q)
VFD
EQ
CHWP-4 (Q)
1
BP-19,21,23

E1 XFMR
E1
X XFMR
E2
X
P
BP
ELEC
B28

T-P-1
GMU-1
P-1
EQ
1
BP-25

MECH
B2

E100 - BASEMENT POWER PLAN
1/8" = 1'-0"

## ELECTRICAL POWER KEYED NOTES

1 PROVIDE NEW ELECTRICAL CONNECTION TO NEW MECHANICAL UNIT.

2 PROVIDE NEW BREAKER IN EXISITNG CUTLER-HAMMER PRL-2A TYPE PANEL. MATCH EXISTING PANEL AIC RATING.

## PANEL: BP

**LOCATION:** MECH B2 **VOLTS:** 480/277 WYE, 3PH, 4W **A.I.C. RATING:** 25000
**FED FROM:** E2 **RATING:** 225 A, MCB **MOUNTING:** SURFACE

| CKT | CIRCUIT DESCRIPTION | TRIP | POLES | A | | B | | C | | POLES | TRIP | CIRCUIT DESCRIPTION | CKT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 5817 | | | | | | | | | 2 |
| 3 | BOILER PUMP 1 | 50 A | 3 | | | 5817 | | | | | | | 4 |
| 5 | | | | | | | | 5817 | | | | | 6 |
| 7 | | | | 5817 | | | | | | | | | 8 |
| 9 | BOILER PUMP 2 | 50 A | 3 | | | 5817 | | | | | | | 10 |
| 11 | | | | | | | | 5817 | | | | | 12 |
| 13 | | | | 3878 | 18000 | | | | | | | | 14 |
| (2) 15 | CHWP-3 | 25 A | 3 | | | 3878 | 18000 | | | 3 | 90 A | WATER HEATER | 16 |
| 17 | | | | | | | | 3878 | 18000 | | | | 18 |
| 19 | | | | 3878 | | | | | | | | | 20 |
| (2) 21 | CHWP-4 | 25 A | 3 | | | 3878 | | | | | | | 22 |
| 23 | | | | | | | | 3878 | | | | | 24 |
| (2) 25 | GMU-1 | 20 A | 1 | 500 | | | | | | | | | 26 |
| 27 | | | | | | | | | | | | | 28 |
| 29 | | | | | | | | | | | | | 30 |
| 31 | | | | | | | | | | | | | 32 |
| 33 | | | | | | | | | | | | | 34 |
| 35 | | | | | | | | | | | | | 36 |
| 37 | | | | | | | | | | | | | 38 |
| 39 | | | | | | | | | | | | | 40 |
| 41 | | | | | | | | | | | | | 42 |
| | | **TOTAL LOAD:** | | 37890 VA | | 37390 VA | | 37390 VA | | | | | |
| | | **TOTAL AMPS:** | | 137 A | | 135 A | | 135 A | | | | | |

| LOAD CLASSIFICATION | CONNECTED LOAD | DEMAND FACTOR | ESTIMATED DEMAND |
|---|---|---|---|
| HVAC | 23768 VA | 100.00% | 23768 VA |
| Spare | 88902 VA | 100.00% | 88902 VA |

**PANEL TOTALS**
**TOTAL CONN. LOAD:** 112670 VA
**TOTAL EST. DEMAND LOAD:** 112670 VA
**TOTAL CONN. LOAD (A):** 136 A
**TOTAL EST. DEMAND (A):** 136 A

**NOTES:**

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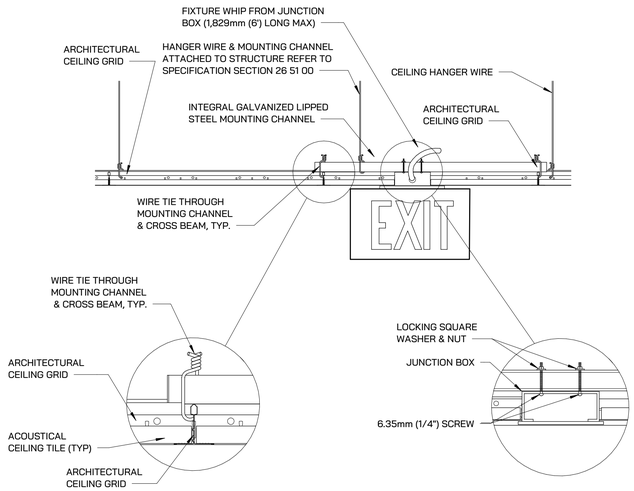
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

BASEMENT POWER PLAN

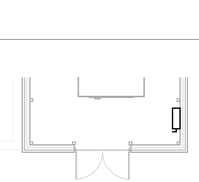
E100

# OF #




GENERAL NOTE:
1. INSTALL IN ACCORDANCE WITH MANUFACTURER'S MOUNTING INSTRUCTIONS AND USING THE RECOMMENDED MOUNTING HARDWARE.

2 / E200 **EXIT SIGN MOUNTING - LAY-IN CEILING**
SCALE: NONE

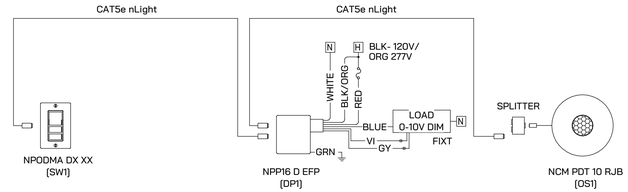


REFER TO OUTDOOR POWER PLAN FOR CONTINUATION

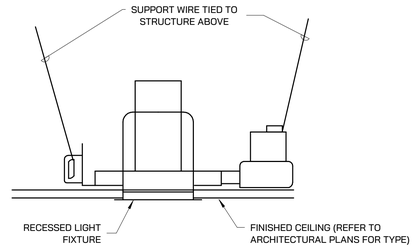
## ELECTRICAL LIGHTING KEYED NOTES

1 PROVIDE NEW LIGHTING AND CONNECT TO EXISTING CIRCUIT. EXTEND WIRING AS REQUIRED.

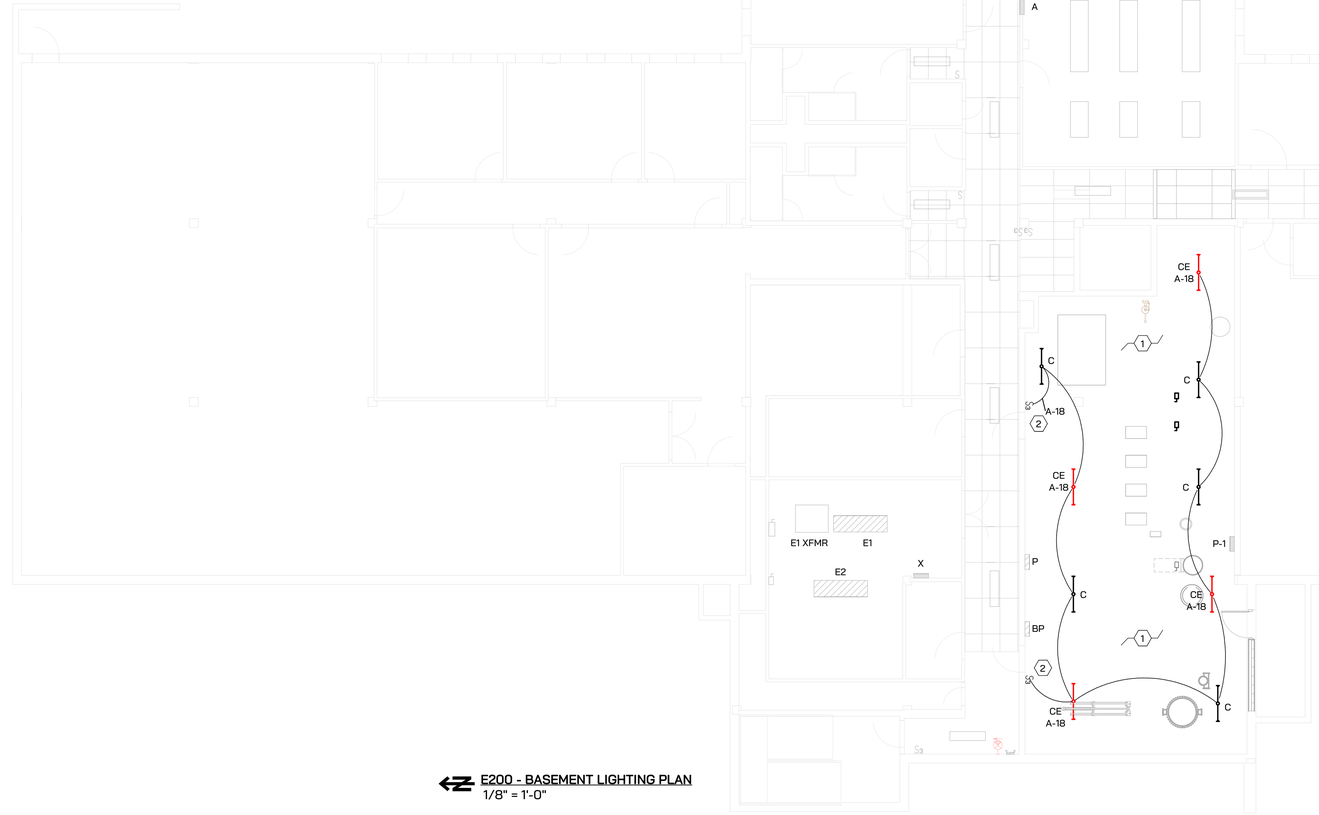
2 PROVIDE NEW SWITCH AND COVER PLATE IN PLACE OF EXISTING. CONNECT TO EXISTING CIRCUIT.




3 / E200 **NLIGHT LIGHTING CONTROL**
SCALE: NONE




4 / E200 **RECESSED DOWNLIGHT MOUNTING DETAIL**
SCALE: NONE




E200 - BASEMENT LIGHTING PLAN
1/8" = 1'-0"

## LIGHT FIXTURE SCHEDULE

| TYPE | DESCRIPTION | MOUNTING | DRIVER | LOAD | MANUFACTURER | NOTES |
|---|---|---|---|---|---|---|
| C | INDUSTRIAL | CABLE | 0-10V | 32 VA | LITHONIA: #CLX-L48-5000LM-SEF-FDL-MVOLT-GZ10-40K-80CRI-WH | |
| CE | INDUSTRIAL WITH BATTERY | CABLE | 0-10V | 32 VA | LITHONIA: #CLX-L48-5000LM-SEF-FDL-MVOLT-GZ10-40K-80CRI-WH-E10W | 1 |

LIGHT FIXTURE NOTES:

1. PROVIDE FIXTURE WITH BATTERY PACK. BATTERY SHALL COME ON WHEN POWER FAILS AND OPPERATE THE FIXTURE A MINUMUM OF 90 MINUTES.

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| | |
|---|---|
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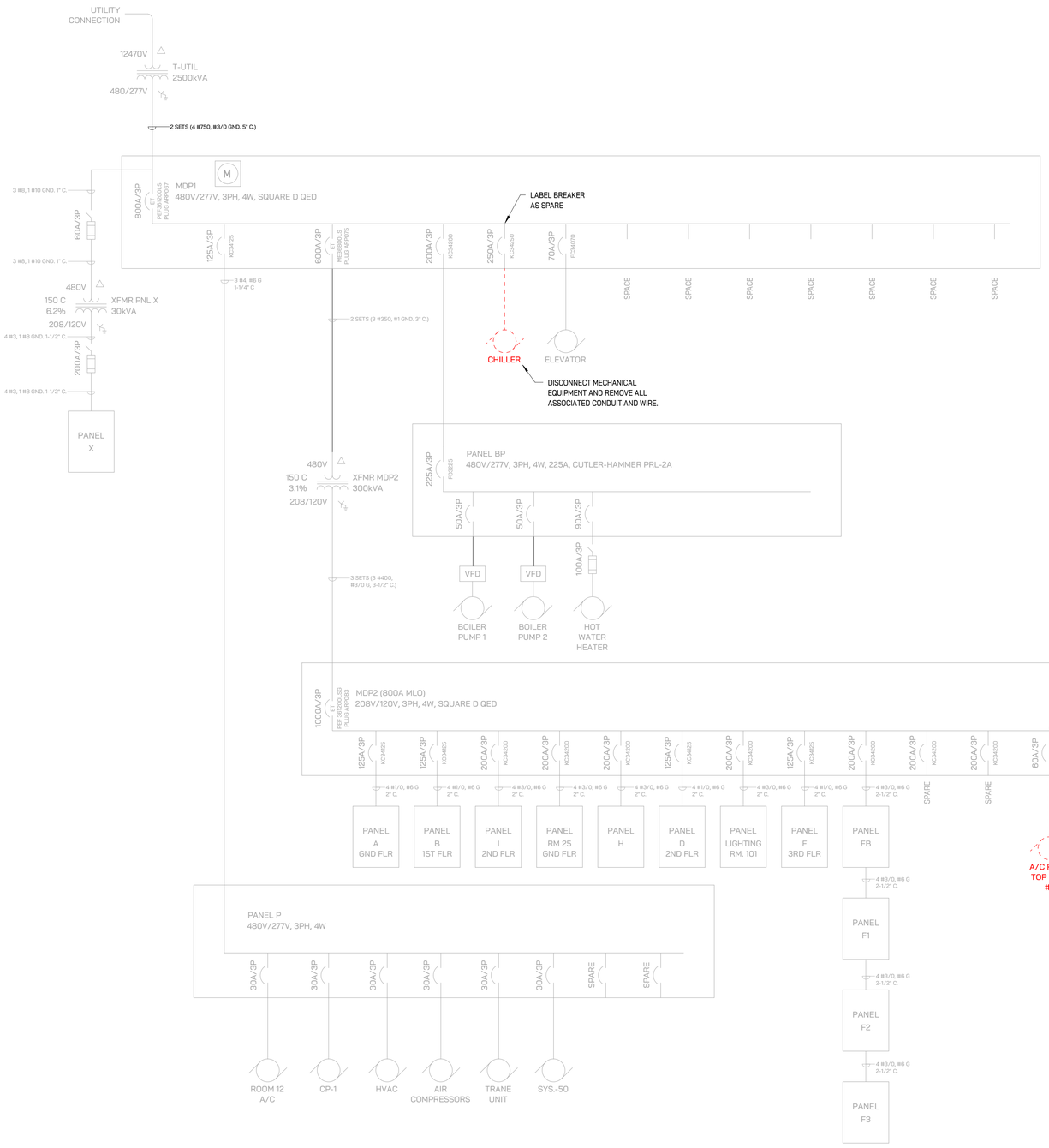
| ARCH. | GOODMAN |
| MECH. | ADAMCZYK |
| ELEC. | BECRAFT |
| CIVIL | |
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/8" = 1'-0" |
| ISSUED | |
| Project Status | |

BASEMENT LIGHTING PLAN

E200

# OF #




58 - ELECTRICAL ONE LINE DIAGRAM DEMOLITION
1/4" = 1'-0"

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| L.A. | |
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| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/4" = 1'-0" |
| ISSUED | |
| Project Status | |

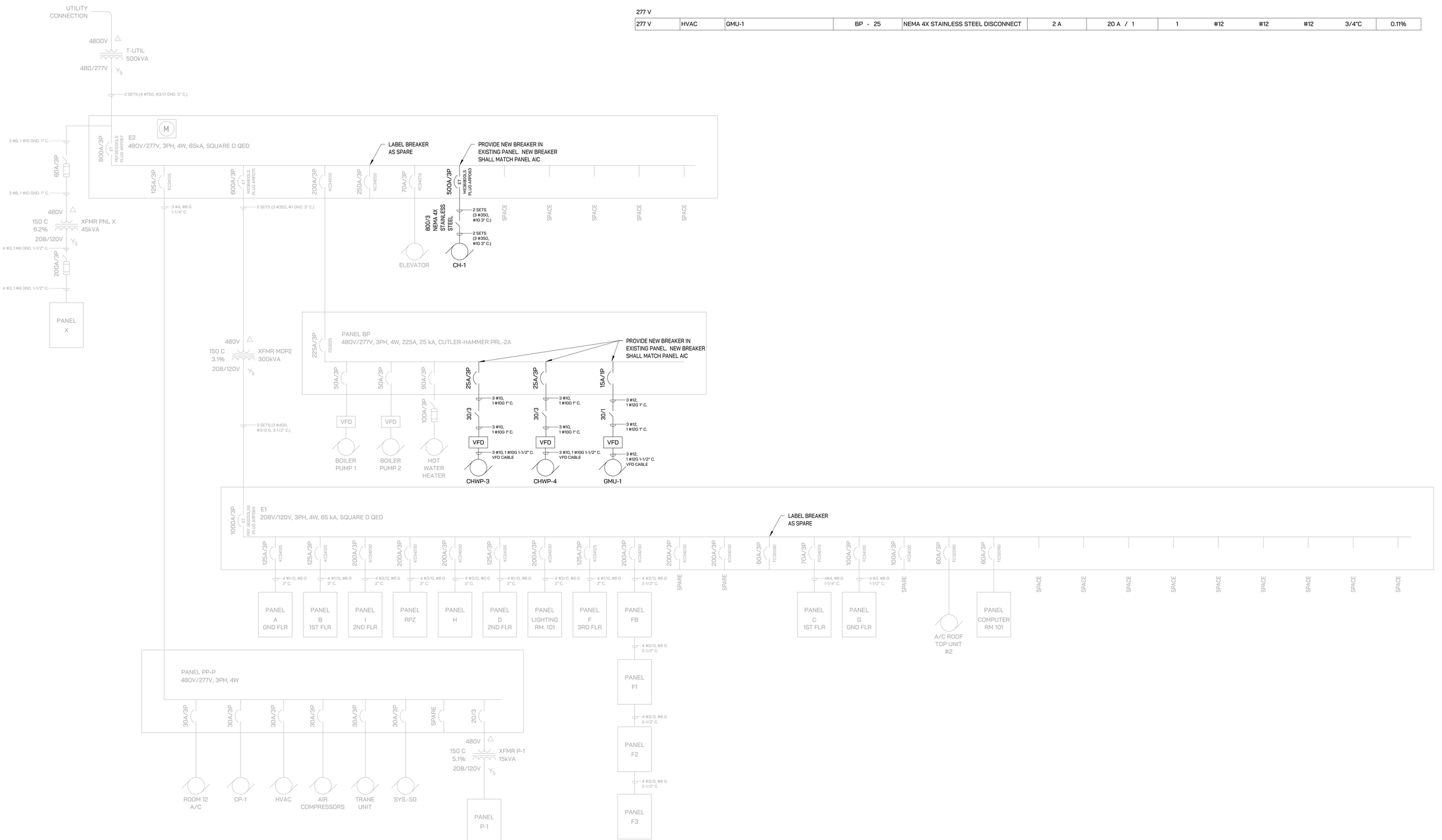
ELECTRICAL ONE-LINE DIAGRAM DEMOLITION

E401

# OF #

## ELECTRICAL HVAC BRANCH CIRCUIT SCHEDULE

| Voltage | Load Classification | CIRCUIT DESCRIPTION | FED FROM PANEL - CIRCUIT | DISCONNECTING MEANS | BRANCH CIRCUIT INFORMATION: LOAD CURRENT | BREAKER / POLES | # OF RUNS | WIRE | NEUTRAL | GROUND | CONDUIT | VOLTAGE DROP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 480 V | | | | | | | | | | | | |
| 480 V | HVAC | CHWP-3 | BP - 13,15,17 | NFDS SWITCH AHEAD OF THE VFD | 14 A | 25 A / 3 | 1 | #10 | | #12 | 3/4"C | 0.64% |
| 480 V | HVAC | CHWP-4 | BP - 19,21,23 | NFDS SWITCH AHEAD OF THE VFD | 14 A | 25 A / 3 | 1 | #10 | | #12 | 3/4"C | 0.61% |
| 277 V | | | | | | | | | | | | |
| 277 V | HVAC | GMU-1 | BP - 25 | NEMA 4X STAINLESS STEEL DISCONNECT | 2 A | 20 A / 1 | 1 | #12 | #12 | #12 | 3/4"C | 0.11% |




ELECTRICAL ONE LINE DIAGRAM
1/4" = 1'-0"

Infrastructure Planning and Facilities

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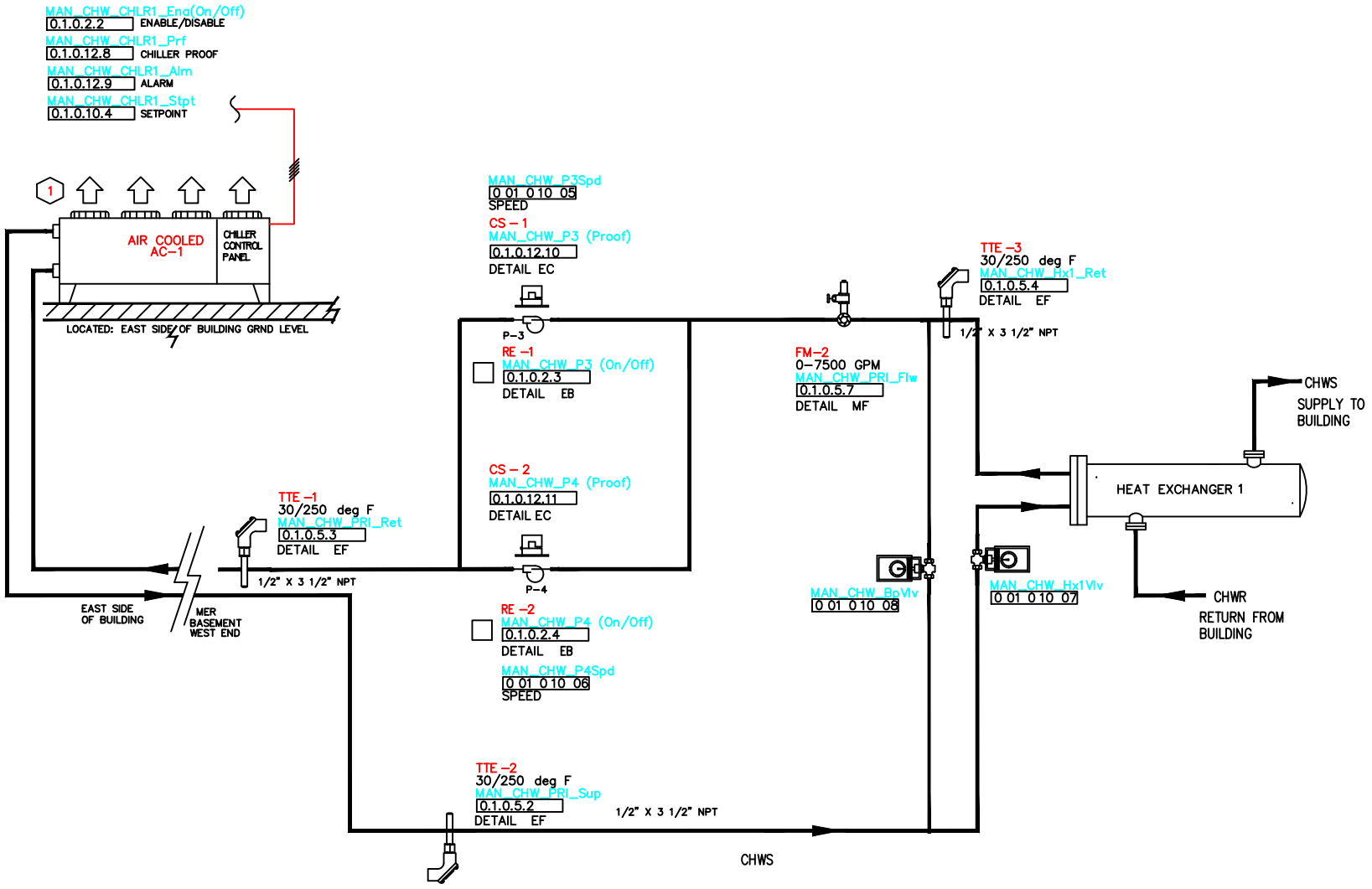
| L.A. | |
| INT. DES. | |
| CONST. REP. | |
| APPR. | ---- |
| DATE | 03/21/2025 |
| SCALE | 1/4" = 1'-0" |
| ISSUED | |
| Project Status | |

ELECTRICAL ONE-LINE DIAGRAM

E402

# OF #

# Manly Miles Heating Hot Water System Control Diagram




Building Number 0154

MANLY MILES

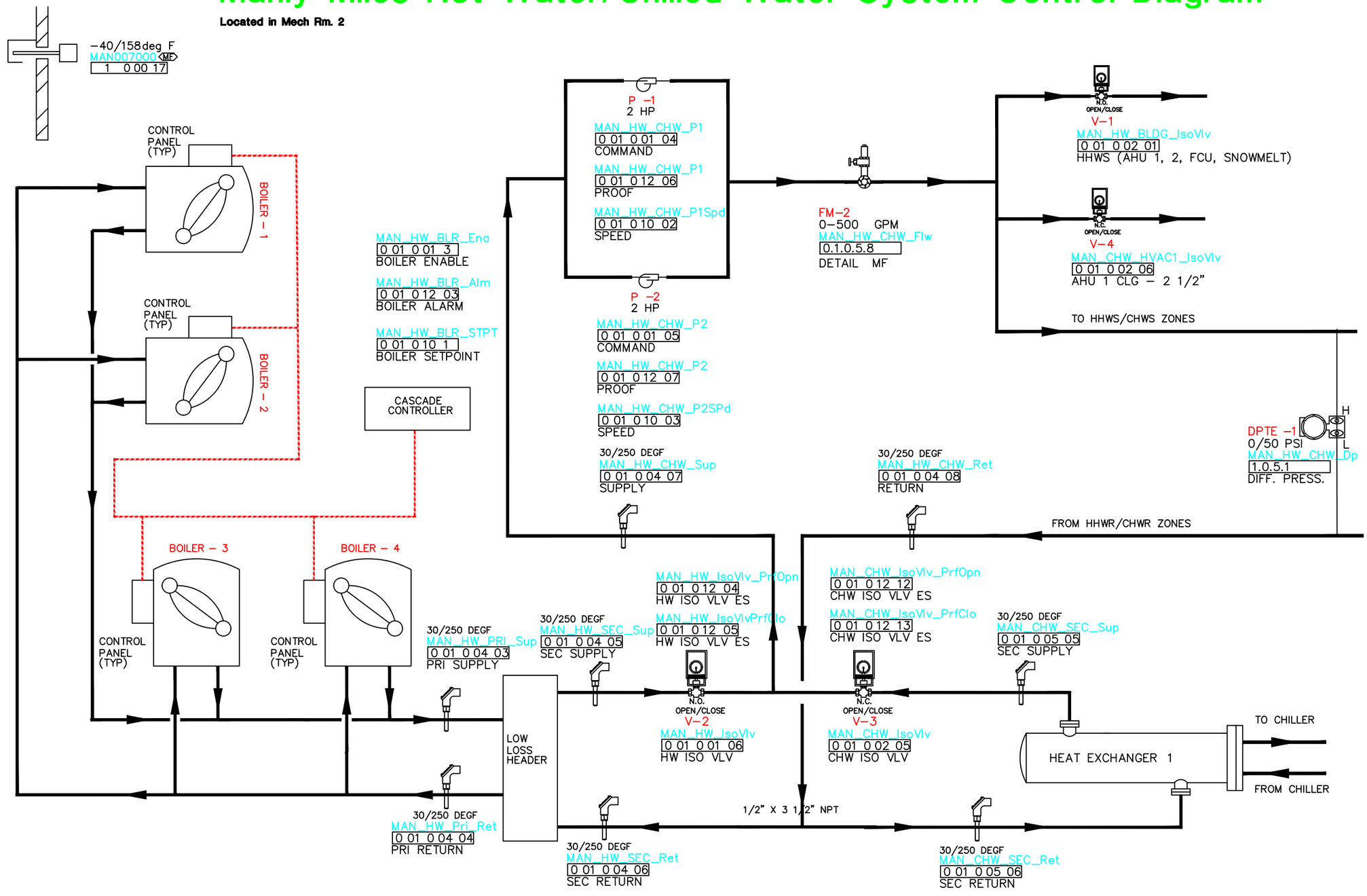
| ENGINEER | DRAFTER | CHECKED BY | INITIAL RELEASE | LAST EDIT DATE |
|---|---|---|---|---|
| RPG | RPG | RPG | 6/10/16 | 4/24/26 |

CHILLED WATER SYSTEM


MSU
Michigan State University
HVAC Central Control
124 Physical Plant
HVAC Central Control
East Lansing 48824
USA
517.353.4969
517.355.5205 (Fax)

# Manly Miles Hot Water/Chilled Water System Control Diagram

**Located in Mech Rm. 2**




Building Number 0154

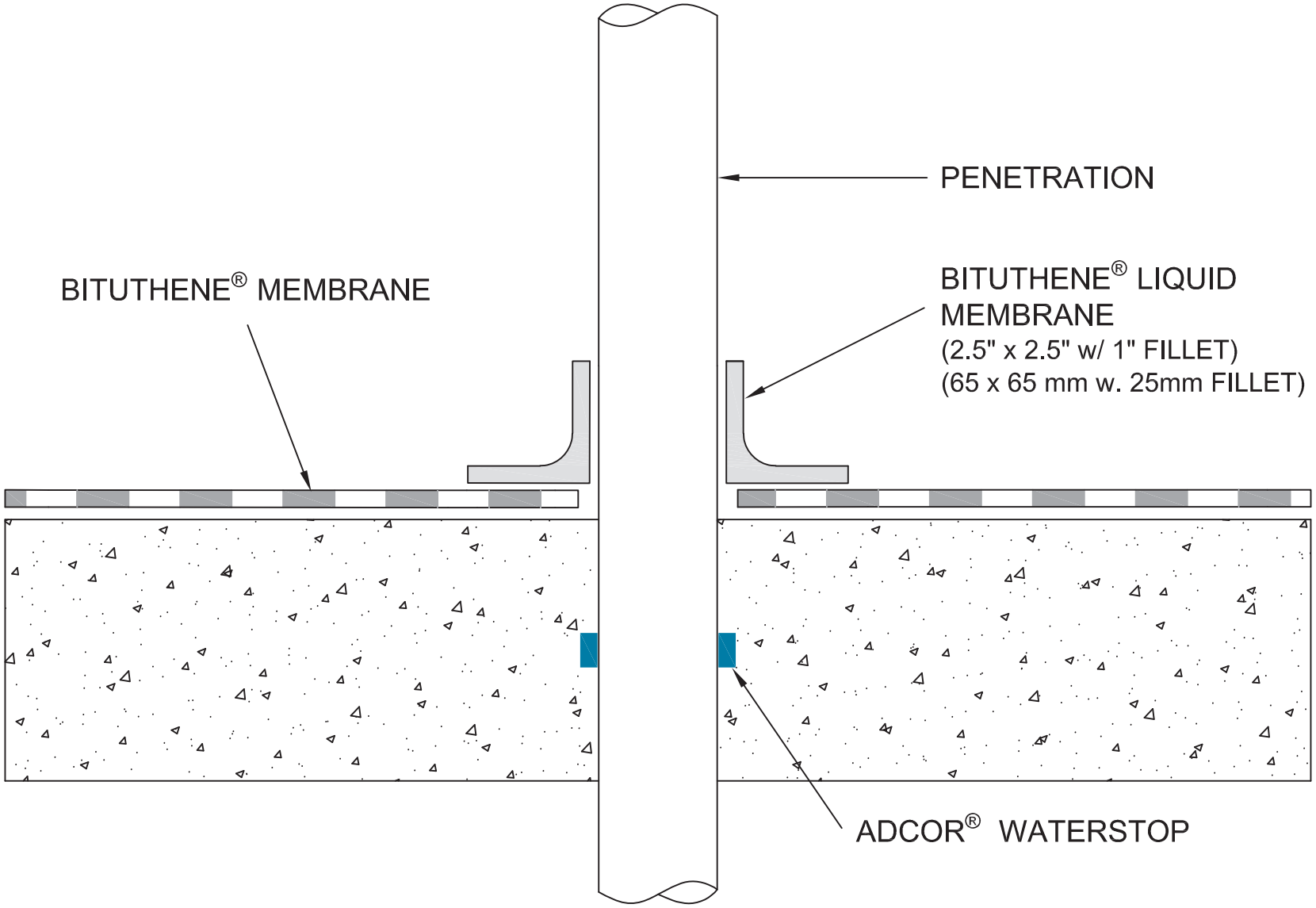
MANLY MILES

| ENGINEER | DRAFTER | CHECKED BY | INITIAL RELEASE | LAST EDIT DATE |
|---|---|---|---|---|
| RPG | RPG | RPG | 6/10/16 | 5/19/25 |

CHW/HOT WATER SYSTEM


124 Physical Plant
HVAC Central Control
East Lansing 48824
USA
517.353.4669
517.355.5205 (Fax)

MSU
Michigan State University
HVAC Central Control




NOTES - HYDRODUCT® OR APPROVED PROTECTION COURSE NOT SHOWN FOR CLARITY
- GCP MAY REQUIRE AN ALTERNATE GCP WATERSTOP BASED ON DESIGN CONDITIONS

gcp applied technologies

# PENETRATION

## BITUTHENE® WATERPROOFING SYSTEM

| |
|---|
| DRAWING: BIT-016 |
| SCALE: Not to scale |
| EFFECTIVE DATE: 07/01/2016 |
| SUPERCEDES: 04012015 |

INSTALLATION INSTRUCTIONS

# Penetration

Prior to Membrane Installation, Review the Bituthene® Data Sheet

**Surface Prep**

All surfaces must be structurally sound and free from spalled areas, loose aggregate, sharp protrusions or other matter that may hinder the adhesion or regularity of the membrane installation. The surface should also be free from frost, dirt, grease, oil or other contaminants as outlined in the Bituthene® Data Sheet section on Surface Preparation. Clean loose dust and dirt from the surface and prime with appropriate primer.

**Detailing**

1. Ensure the surface of the penetration is clean and grouted solid to prevent movement.
2. Apply Bituthene membrane onto substrate in accordance with the Bituthene Data Sheet section on Installation.
3. Cut membrane to allow for penetration. Membrane should be within 0.5 in (15 mm) in of penetration after cutting.
4. Apply 90-mil (2.3 mm) thick Bituthene Liquid membrane 2.5 in (65 mm) onto penetration and onto membrane.
5. Apply Hydroduct 220 for vertical applications or Hydroduct 660 for horizontal applications according to each according to Hydroduct Data Sheet.

**Special Notes**

Bituthene membranes should not be used in areas where they will be permanently exposed to sunlight, weather or traffic. Protect membrane from sunlight as quickly as possible after installation.

Ensure Adcor® waterstop is encapsulated with 3 in (75 mm) of concrete cover minimum. Apply Adcor® waterstop according to the installation instructions found on the data sheet.

GCP may require an alternative GCP waterstop based on design conditions, at GCP's discretion.