ADDENDUM NO. 01

DATE: **July 24, 2024**

PROJECT: **Goshen Public Library**
601 S. 5th St.
Goshen, IN 46526

PROJECT NUMBER (RATIO): **21730.002**

OWNER:
Goshen Public Library
601 S. 5th St.
Goshen, IN 46526
Phone: (574) 533-9531

ARCHITECT:
RATIO Architects, LLC.
101 S. Pennsylvania St.
Indianapolis, IN 46204
Phone: (317) 275-6693

CIVIL ENGINEER:
ForeSight Consulting, LLC
1910 St. Joe Center Rd., STE 51
Fort Wayne, IN 46825
Phone: (260) 484-9900

STRUCTURAL ENGINEER:
CE Solutions
8770 North St. #100
Fishers, IN 46038
Phone: (317) 818-1912

MECHANICAL / PLUMBING / ELECTRICAL ENGINEER:
KBSO Consulting, LLC
275 Veterans Wy, Suite 300
Carmel, IN 46032
Phone: (317) 344-8044

William A. Browne, Jr. *(or other)*

This Addendum is issued in accordance with the provisions of Contract Documents and becomes a part of the Contract Documents as provided therein. The information contained herein modifies the original Bidding Documents dated **June 27, 2024** and all prior Addenda as applicable. Requirements of the original Bidding Documents and previous Addenda remain in effect except as modified by this Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

PART 1 – GENERAL CLARIFICATIONS

1. Pre-bid questions and responses:

   a. **Question 1:** Is there a requirement to provide temporary heating and cooling as part of the project.
      i. **Answer:** Yes. We've included an additional allowance #3 within specification section 012100 Allowances to provide money for temporary power, heating and cooling. A major goal of the project is to maintain building function, including reasonable temperature and humidity control, so that library operations can be maintained and the contents of the building remain protected (such as existing plumbing, books, etc). The library understands there may be some weeks without full function, but the library would like to maintain power, lighting, and temperature / humidity control for staff to occupy the building and provide curbside service.

   b. **Question 2:** Does the existing chiller utilize glycol for chilled water?
      i. **Answer:** No, the current chiller utilizes R-22 refrigerant.

   c. **Question 3:** Do contractors have access to the building prior to the bid?
      i. **Answer:** Yes. Please contact Ross Ricker at the Library for access. His contact info:
         Ross Ricker
         Head of Support Services
         574-533-9531 ext. 215
         reriker@goshenpl.org

         Alternatively, if Ross is unavailable, please contact Ann-Margaret Rice (Director)
         Ann-Margaret Rice
         Director
         574-533-9531 ext. 211
         amrice@goshenpl.org

   d. **Question 4:** Can the south parking lot be used for construction staging?
      i. **Answer:** Yes, the south parking lot may be utilized for construction staging. However, areas of the north parking lot (primarily the north end of the lot) can be utilized for construction personnel parking, job trailer, etc. The library would like to maintain operations to the furthest extent possible during construction, therefore, the parking spaces closest to the library should remain available for staff and library patrons.

   e. **Question 5:** Who is responsible for the asbestos abatement, or has it already been performed?
      i. **Answer:** It's our understanding, based upon review of the abatement report, there is no asbestos abatement work anticipated within the areas of work for this project scope. If suspected asbestos is found within the areas of work, please follow the contract documents and notify the Owner and Architect immediately.

   f. **Question 6:** On Drawing P-501 Detail 4 there are two Flow Meters, typical shown. Can you provide more information on what you are wanting for these flow meters?
      i. **Answer:** We have re-issued specification section 230923 which provides more information on the Flow Meter requirements.

   g. **Question 7:** On drawing MP-103 note #5 states to use Gilsulate 500 XR to insulate the underground chilled water piping. Would pre-insulated pipe be acceptable?
      i. **Answer:** Yes, pre-insulated pipe is acceptable. The notes and specifications have been revised in this addendum to allow pre-insulated pipe.

h. **Question 8**: Regarding temporary heating and cooling for the project. Since temporary heating and cooling is not included in the bid documents and that different contractors could have a different approach to what is needed would it be possible to make temporary heating and cooling an allowance?
   i. **Answer**: We have updated the Allowance specification to include money for temporary power, heating and cooling.

2. Pre-bid meeting attendee list:

   a. 7.16.2024 – Pre-Bid Meeting
   i. Gibson-Lewis
   ii. Hamilton Hunter
   iii. Herman and Goetz
   iv. Innovative Control Systems
   v. J.O. Mory
   vi. Middlebury Electric
   vii. Nuway Construction
   viii. Schenkel Construction
   ix. Shawnee Construction
   x. Shambaugh & Sons
   xi. R. Yoder Construction

3. Bid Opening will be held in-person at the Goshen Public Library in their Lower Level Community Room. The meeting will also have a dial in using the following information:
   a. Call in phone number: 1-773-917-5169
   b. Phone conference ID: 241 655 599#

4. Existing building drawings can be accessed for view at the following location:
   a. https://ratioarchitects-my.sharepoint.com/:f:/g/personal/asgro_ratiodesign_com/ErpvSX0jKftOjr3MSkcmI54BKaiwulf4PttS3ab_eYW38g?e=lrHPGf

PART 2 - PROJECT MANUAL CHANGES

1. **SECTION 000001 – TABLE OF CONTENTS**
   a. Add sections 012300 Alternates, 081113 Hollow Metal Doors and Frames, 087100 Door Hardware.

2. **SECTION 012100 – ALLOWANCES**
   a. Insert paragraph 3.3.C as follows:
      i. **"C. Allowance No. 3: Temporary Utilities Allowance: Include $75,000.00 allowance for the contractor to be responsible for costs, safety requirements, compliance with all applicable codes and guidelines in order to supply temporary electrical service and temporary equipment for temperature control during construction. Heating and cooling service shall maintain an occupiable temperature in the facility of between 68 deg F to 76 deg F between 6am and 10pm and at least 55 deg F between 10 pm to 6 am.**
      ii. **1. Unused amount of the allowance will be returned to Owner at date of Substantial Completion."**

3. **SECTION 012300 – ALTERNATES**
   a. Add specification section in its entirety.

4. **SECTION 081113 – HOLLOW METAL DOORS AND FRAMES**
    a. Add specification section in its entirety.

5. **SECTION 087100 – DOOR HARDWARE**
    a. Add specification section in its entirety.

6. **SECTION 099600 – HIGH PERFORMANCE COATINGS**
    a. Delete sub-paragraphs 2.1.A.1, 3, 4, 5, and 7.
    b. Delete sub-paragraph 3.1.B.3.
    c. Insert paragraph 3.7.B as follows:
        i. **"B. Factory Primed Doors and Frames:**
            1. Alkyd Enamel System:
                a. Prime Coat: Universal primer:
                1) Pro Industrial Pro-Cryl Universal Primer, B66 1300 Series, at 1.9 to 3.8 mils dry, per coat.
                b. Topcoat: Alkyd enamel:
                1) Direct-to-Metal Alkyd Enamel Semi-Gloss, B55-100 Series, at 3.0 to 5.6 mils dry, per coat."

7. **SECTION 230923 – DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC**
    a. Added Delta Controls as an acceptable manufacturer with Innovative Control Systems, LLS as installation service contractor.
    b. Removed operator workstation completely, section 2.7.
    c. 2.3.D.1: changed spare capacity to 120% in lieu of 125%.
    d. Removed requirement for local keypad and display for network controllers and application controllers; sections 2.10.C.2 and 2.11.C.2.
    e. Added in-line electromagnetic flow meters for domestic water softeners.

8. **SECTION 232113.13 – UNDERGROUND HYDRONIC PIPING**
    a. Added underground pre-insulated steel pipes and fittings as an option. Contains specification and manufacturers for pre-insulated factory fabricated piping with carrier pipe, insulation, and casing.

9. **SECTION 233600 – AIR TERMINAL UNITS**
    a. Added section in its entirety.

10. **SECTION 323342 – SITE FURNISHINGS**
    a. Insert item 1.2.B.1 as follows:
        i. **"1. Section 012300 "Alternates" for Swing assembly and associated concrete slab."**

PART 3 - DRAWING CHANGES

1. **SHEET C0.1 – SITE SPECIFICATIONS**
    a. Changed #4 Earthwork Spec and included a note saying disposed material must be documented and disposed of at a proper permitting location.
    b. Took out #7 Earthwork Spec that discussed mounds because it does not apply.
    c. Took out #8 Water System Spec that discussed copper tubing because it does not apply.

2. **SHEET C0.2 – SITE SPECIFICATIONS**
    a. Changed #9 Sanitary Sewer Spec and took out the option of HDPE piping as it doesn't follow city ordinances when it comes to open-cut gravity sanitary sewer installation.

3. **SHEET C1.1 – SITE DEVELOPMENT PLAN**
    a. Showing outline of pavilion with dimensions and labeled with height.
    b. Notes showing heights of chiller wall and dumpster wall height.
    c. Added 3 “no truck parking” signs, including one attached to a light post that was also added.
    d. Irrigation note was edited to show preference of location and other notes.
    e. Details for both the north and south drives are shown to ensure ADA is met between walks.

4. **SHEET C2.1 – SITE GRADING PLAN**
    a. Depressed curb was included in both the north and south drives.

5. **SHEET C3.1 – EROSION CONTROL PLAN**
    a. Matched detail with legend label “Woven Wire Mesh Sediment Barrier”
    b. Changed schedule of concrete washout from installing in the first three days to just prior of concrete construction.
    c. Changed construction drive detail to show flared ends at road connection.
    d. Moved concrete washout area to northwest corner of dumpster pad.

6. **SHEET C4.1 – STORMWATER MANAGEMENT PLAN**
    a. The existing inlet in southern drive has been removed.
    b. An inlet along depressed curb at southern drive has been added.

7. **SHEET L1.1 – LANDSCAPING PLAN**
    a. Shows approximate pavilion outline.
    b. Shows “no truck parking” signs
    c. The plant legend now has an extra column showing height at maturity.
    d. Overhead utility lines are shown with dimensions to close proposed trees.
    e. Underground utility lines are now shown, and the south tree was moved slightly to avoid conflict with a storm line.

8. **SHEET S2.1 – TOPOGRAPHIC SURVEY - SOUTH**
    a. Labeled the FDC (Fire Department Connection) to Goshen library

9. **SHEET S2.1 – TOPOGRAPHIC SURVEY - NORTH**
    a. Labeled the FDC (Fire Department Connection) to Goshen library

10. **SHEET A-100 – SITE PLAN**
    a. Add note clarifying the proposed swing and associated concrete pad are part of a bid alternate.

11. **SHEET A-101 – ENLARGED SITE PLAN**
    a. Modify dimensions of chillers within the chiller enclosure.
    b. Add note clarifying the proposed swing and associated concrete pad are part of a bid alternate.

12. **SHEET A-105 – LOWER LEVEL FLOOR PLAN, DOOR SCHEDULE AND DETAILS**
    a. Add Interior Partition Types
    b. Added doors 212A and 234A to door schedule.
    c. Added door hardware set information.
    d. Modify door frame F1 head height to 4”.
    e. Add notes to plan indicating new door and frames.
    f. Add concrete slab-on-grade infill detail.

13. **SHEET A-201 – EXTERIOR ELEVATIONS**
    a. Added notes to clarify color of proposed materials.

14. **SHEET A-321 – WALL SECTIONS**
    a. Added notes to clarify color of proposed materials.

15. **SHEET MP-103 – MECHANICAL SITE PLAN**
    a. Modified keynote 5 to include verbiage about pre-insulated underground piping.
    b. Changed pipe size to 6” CWS&R from building to chillers given 6” was more common for those pipe system types.

16. **SHEET M-401 – SOUTH MECHANICAL ENLARGED PLANS**
    a. Changed pipe size to 6” CWS&R from building to chillers given 6” was more common for those pipe system types.

17. **SHEET M-502 – MECHANICAL DETAILS**
    a. Added pre-insulated underground piping system details 10 and 11.

18. **SHEET M-602 – MECHANICAL SCHEDULES**
    a. Added max height to ceiling fan schedule, note 3.

19. **SHEET M-901 – TEMPERATURE CONTROL SCHEMATICS**
    a. Added control schematic for water softener flow meters.

20. **SHEET M-902 – TEMPERATURE CONTROL SCHEMATICS**
    a. Modified plan note 13 to clarify spare capacity of inputs and outputs.

21. **SHEET M-903 – TEMPERATURE CONTROL SCHEMATICS**
    a. Modified plan note 12 to clarify spare capacity of inputs and outputs.

22. **SHEET ES-002 – SITE ELECTRICAL PLAN**
    a. Added a weatherproof receptacle with in-use cover to new chiller enclosure to the site plan.

23. **SHEET E-101 – FIRST FLOOR ELECTRICAL PLAN**
    a. Added access control panel, devices, cabling, and power associated with a new access control system. See architectural Door Access Control specification for all additional information.

24. **SHEET E-601 – ELECTRICAL SCHEDULES**
    a. Added access control panel (ACP) and door hardware controller (DHC) to the Equipment Electrical Connections Schedule
    b. Added circuits for new receptacle chiller receptacle and door hardware controller to panel schedule H.
    c. Added circuits for door access control panel and door hardware controller to panel schedule C.

25. **SHEET P-402 – NORTH MECHANICAL ROOM PLUMBING ENLARGED PLAN**
    a. Revised plan to show existing backflow preventer.

26. **SHEET P-501 – PLUMBING DETAILS**
    a. Revised water softener piping detail by clarifying information on flow meter.

PART 4 – PREVIOUS ADDENDA

1. N/A (not applicable)

PART 5 – ATTACHMENTS

A. Specification Section:
1. SECTION 000001 – TABLE OF CONTENTS
2. SECTION 012100 – ALLOWANCES
3. SECTION 012300 – ALTERNATES
4. SECTION 081113 – HOLLOW METAL DOORS AND FRAMES
5. SECTION 087100 – DOOR HARDWARE
6. SECTION 099600 – HIGH PERFORMANCE COATINGS
7. SECTION 230923 – DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC
8. SECTION 232113.13 – UNDERGROUND HYDRONIC PIPING
9. SECTION 233600 – AIR TERMINAL UNITS
10. SECTION 323342 – SITE FURNISHINGS

B. Drawings:
1. C0.1 – SITE SPECIFICATIONS
2. C0.2 – SITE SPECIFICATIONS
3. C1.1 – SITE DEVELOPMENT PLAN
4. C2.1 – SITE GRADING PLAN
5. C3.1 – EROSION CONTROL PLAN
6. C4.1 – STORMWATER MANAGEMENT PLAN
7. L1.1 – LANDSCAPING PLAN
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10. A-100 – SITE PLAN
11. A-101 – ENLARGED SITE PLAN
12. A-105 – LOWER LEVEL FLOOR PLAN, DOOR SCHEDULE AND DETAILS
13. A-201 – EXTERIOR ELEVATIONS
14. A-321 – WALL SECTIONS
15. MP-103 – MECHANICAL SITE PLAN
16. M-401 – SOUTH MECHANICAL ENLARGED PLANS
17. M-502 – MECHANICAL DETAILS
18. M-602 – MECHANICAL SCHEDULES
19. M-901 – TEMPERATURE CONTROL SCHEMATICS
20. M-902 – TEMPERATURE CONTROL SCHEMATICS
21. M-903 – TEMPERATURE CONTROL SCHEMATICS
22. ES-002 – SITE ELECTRICAL PLAN
23. E-101 – FIRST FLOOR ELECTRICAL PLAN
24. E-601 – ELECTRICAL SCHEDULES
25. P-402 – NORTH MECHANICAL ROOM PLUMBING ENLARGED PLAN
26. P-501 – PLUMBING DETAILS

END OF ADDENDUM NO. 01

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DIVISION 21 – FIRE SUPPRESSION

DIVISION 22 - PLUMBING

VOLUME 2

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING(HVAC)

DIVISION 25 - INTEGRATED AUTOMATION

END OF TABLE OF CONTENTS

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
2. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

1. Allowance No. 1: General Allowance: Include $150,000.00 allowance, used with written permission of the Owner, for unknowns discovered during construction.

    1. Unused amount of the allowance will be returned to Owner at date of Substantial Completion.

B. Allowance No. 2: Irrigation System Allowance: Include $25,000.00 allowance to cut/cap and make safe the existing irrigation system damaged during construction and include design and installation of irrigation in the renovated south parking lot area. Exact layout of the irrigation system is unknown.

    1. Unused amount of the allowance will be returned to Owner at date of Substantial Completion.

C. Allowance No. 3: Temporary Utilities Allowance: Include $75,000.00 allowance for the contractor to be responsible for costs, safety requirements, compliance with all applicable codes and guidelines in order to supply temporary electrical service and temporary equipment for temperature control during construction. Heating and cooling service shall maintain an occupiable temperature in the

facility of between 68 deg F to 76 deg F between 6am and 10pm and at least 55 deg F between 10 pm to 6 am.

1. Unused amount of the allowance will be returned to Owner at date of Substantial Completion.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Commercial Contour Bench Swing.

1. Base Bid: Shall not include a Commercial Contour Bench Swing and associated concrete slab as indicated on Drawing and as specified in Section 323342 “Site Furnishings.”
2. Alternate: Shall include Commercial Contour Bench Swing and associated concrete slab as indicated on Drawing and as specified in Section 323342 “Site Furnishings.”

END OF SECTION 012300

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 099600 “High-Performance Coatings” for colors of frames and doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.

C. Samples for Verification:

1. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

   a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
   b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1. Provide additional protection to prevent damage to factory-finished units.

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

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY.
2. Pioneer Industries; AADG, Inc.; ASSA ABLOY.
3. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having

jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard.
f. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated and temperature-rise-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Construction: Full profile welded.

1) Provide top frame member at 4 inches tall to match adjacent existing frames on site.

B. Exposed Finish:

1. Factory Prime.
2. Field paint per Section 099600 “High-Performance Coatings.”

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. 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 hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

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

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 or NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Adjust hollow-metal frames 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.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

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

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.
4. Integrated Credentials and En

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 284621.11 "Addressable Fire-Alarm Systems" for connections to building fire-alarm system.

1.2 COORDINATION

A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Samples for Initial Selection: For each type of exposed finish.

1. Provide full range of manufacturer’s colors.

E. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

F. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
   a. Mechanical Warranty

      1) Locks: Ten (10) years
      2) Exit Devices: Ten (10) years
      3) Closers: Thirty (30) years
      4) Automatic Operators: Two (2) years

   b. Electrical Warranty

      1) Exit Devices: Three (3) years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

E. INTEGRATED CREDENTIAL READERS AND ENTRY MANAGEMENT

1. Provide compatible Integrated Credential Readers and Entry Management at locations indicated on Drawings to include:

    a. Offline Controller.
    b. Access Control Platform.
    c. Access Control Reader.
    d. Credential Control Reader.
    e. Access Control Credentials.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.
    d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

    a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.

b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

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

   a. Allegion plc.
   b. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
   c. STANLEY; dormakaba USA, Inc.

6. Basis of Design Product: McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 EXIT DEVICES AND TRIM

A. Exit Devices and Auxiliary Items: BHMA A156.3.

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

   a. Allegion plc.
   b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
   c. dormakaba USA Inc.

2. Basis of Design Products:

   a. Exit device: Von Duprin 33/35AA Series (VON), a division of Allegion.
   b. Trim: Von Duprin 98/99 Series (VON), a division of Allegion.
   c. Replacement Exit Device: Von Duprin QEL9927EO (VON), Grade 1.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.

3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non-fire-rated openings.
11. Provide electrified options as scheduled.
12. Top latch mounting: double- or single-tab mount for steel doors.
13. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.5 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
3. Double-lipped strikes: For locks at double acting doors.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.6 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where

specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

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

    a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
    b. Allegion plc.
    c. STANLEY; dormakaba USA, Inc.

2. Basis of Design Product: HES (HS) – 1500/1600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five (5) year warranty.

2.7 INTEGRATED CREDENTIAL READERS AND ENTRY MANAGEMENT

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

1. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
2. Allegion plc.
3. dormakaba USA, Inc.

B. Offline Controller.

1. Basis of Design Manufacturer and Product: Schlage CTE Engage Controller.

2. Requirements:

    a. Provide an offline single opening controller UL 294 listed and compatible with the Schlage Engage Application. Include a multi-technology reader kit.
    b. Provide interfaces for a multi-technology credential reader, powered and dry output relays for strike, alarm, and auxiliary function, and with wireless communication capability.
    c. Provide offline controller with the following power options:

        1) Power Over Ethernet (POE)

            a) 0.5A at 12 VDC for up to 500 feet.
            b) 1.5A at 24 VDC for up to 500 feet.

        2) 12 VDC in 2A at 12 VDC for up to 500 feet.
        3) 24 VDC in 2A at 24 VDC for up to 500 feet.

    d. Provide offline controller with the following communication standards:

        1) Bluetooth low energy version 4.2.
        2) 2.4 GHz Wi-Fi (IEEE 802.11b/g/n).
        3) WPA2, WPA, WEP, 802.1x (PEAP).

4) Transport Layer Security (TLS) version 12.
5) Advanced Encryption Standard (AES) 256-bit.

e. Provide offline controller with the following signal inputs:

1) One Schlage MT11-485 or MT15-485 reader.
2) Request to Enter (REN).
3) Request to Exit (REX).
4) Remote Release – hardwired.
5) Door Position Switch (DPS).
6) Reader tamper (TAMP).

f. Provide offline controller with the following signal outputs:

1) Card Reader 0.3A at 12 VDC for up to 500 feet.
2) Locking mechanism: 2A at 30 VDC max.
3) Auxiliary: 2A at 30 VDC max.
4) Alarm: 2A at 30 VDC max.

g. Provide offline controller with the following with operating temperatures between -31 F (-35 C) to 151 F (66 C).
h. Provide offline controller with the following on board database:

1) up to 5,000 users
2) up to 2,000 audits (FIFO)
3) up to 16 Time Zones
4) up to 32 Holiday Schedules
5) up to 16 Schedules (lock & unlock)
6) Provide offline controller with the following connectivity options:
7) Apple or Droid smart phone – Bluetooth updates to CTE.
8) Wi-Fi access point – automatic daily updates (one time per day) if connected to Wi-Fi.

i. Provide offline controller with “No-Tour” with MT20W enrollment reader and Schlage 1K smart credentials (13.56 MHz).

C. Access Control Platform.

1. Basis of Design Manufacturer and Product: Schlage Engage (Commercial).

2. Requirements:

a. Provide a cloud-based platform capable of managing users, credentials, access rights, schedules, and audits.
b. All locks must be supplied in construction mode.
c. Provide a platform that supports a mobile application (app). Mobile application must allow for:

1) Commissioning and configuring devices
2) Immediately updating door files
3) Retrieving audit information

4) Performing firmware updates

d. Provide software set up on the owner's workstation and Mobile Device which includes:

1) Creation of the Owner's Account
2) Creation of the Project Site
3) Creation of the Team as directed by the Owner
4) Addition of five users
5) Set up of MT20W and update firmware
6) Create unique credentials and verify proper commissioning of ten locks

e. Provide, at the owner's request, the following on-site training prior to the expiration of the service agreement:

1) Completing the following with ENGAGE software:
2) Modifying the Team
3) Move in/move out procedure including

a) Adding and Deleting Users
b) Adding and Deleting Doors

4) Adding, assigning and programming credentials for access
5) Replacing or deleting lost credentials.
6) Retrieving and viewing of audit information
7) Assigning temporary access
8) Commissioning and verifying proper functioning between locks and credentials.
9) Updating firmware on the locks.

f. Must include a service agreement ending a year after Substantial Completion. This service agreement includes being on-site up to 8 hours for set-up and training, as listed above.

D. Access Control Reader.

1. Basis of Design Manufacturer and Product: Schlage MTB Series.

2. Requirements:

a. Provide access control card readers manufactured by a global company who is a recognized leader in the production of access control devices. Card reader manufactured for non-access control applications are not acceptable.
b. Provide multi-technology contactless readers complying with ISO 14443.
c. Provide access control card readers capable of reading the following technologies:

1) CSN - DESFire CSN, HID iCLASS CSN, Inside Contactless PicoTag CSN, ST Microelectronics CSN, Texas Instruments Tag-It, CSN, Phillips I-Code CSN.
2) 125 KHz proximity - Schlage® Proximity, HID Proximity, GE/CASI Proximity, AWID Proximity, LenelProx.
3) 13.56 MHz Smart card - Schlage smart cards using MIFARE Classic EV1/EV3, Schlage smart cards using MIFARE Plus, Schlage smart cards using MIFARE DESFire EV1/EV3, Schlage smart cards using MIFARE DESFire EV2/EV3.
4) 13.56 MHz NFC (mobile), 2.45 GHz Bluetooth (mobile) - Mobile means compatible with Bluetooth and NFC-enabled smartphones.

E. Credential Control Reader.

1. Basis of Design Manufacturer and Product: Schlage MT20W.

2. Requirements:

a. Unit provides simplified credential enrollment via computer connect. USB connection is for power only, enrollment uses Wi-Fi connection.
b. Multi-technology enrollment reader is designed to simplify the enrollment of proximity and smart credentials. The reader is powered by a USB cable via computer's USB port and utilizes a Wi-Fi connection for certain scenarios (enrolling no-tour credentials).
c. The unit is compatible with smart credentials (MIFARE Classic and FIFARE DESFire EV1/EV3), Schlage Mobile credentials, PIV credentials and most proximity credentials up to 37-bits. The unit supports no-tour (with supported locks) via Schlage MIFARE Classic or MIFARE DESFire EV1/EV3 credentials.

F. Access Control Credentials.

1. Basis of Design Manufacturer and Product: Schlage.

2. Requirements:

a. Provide access control credentials ISO 14443 compliant and GSC-IS® certified compatible with access control readers that allow authorized entry and hold information specific to the user.
b. Provide credentials that have an ISO MIFARE microprocessor, function at 13.56 MHz, 8kbits of memory, open memory architecture, and a passive design requiring no batteries.
c. Provide credentials made of a composite material for added durability that have a read range of up to 4 inches, support up to a 40-bit format.
d. Provide credentials which, when presented to the access control reader at any angle within a minimum distance of one 1-inch, will result in an accurate reading of the card.
e. Provide a total of 50 total credentials.

1) Architect to confirm quantity and type of credentials from the Shop Drawings.

2.8 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a Thirty (30) year warranty.

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

a. Allegion plc.
b. Norton Door Controls; ASSA ABLOY.
c. Rixson Specialty Door Controls; ASSA ABLOY.

3. Basis of Design Product: Manufacturers: Sargent Manufacturing (SA) – LDP-351 Series

2.9 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

2.10 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.11 KEYING

A. General: Cylinder manufacturer to have minimum 10 years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Restricted Keyway.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.12 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

B. Keys: Nickel silver or Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.13 ARCHITECTURAL SEALS AND GASKETING

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

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

a. Hager Companies.
b. National Guard Products, Inc.
c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2. Basis of Design Manufacturer: S88 Silicone, Pemko Manufacturing Company Inc. (PMK).

G. Maximum Air Leakage: When tested in accordance with ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. of door opening.

2.14 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed

unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

   a. Wood or Machine Screws: For the following:

      1) Hinges mortised to doors or frames.
      2) Strike plates to frames.
      3) Closers to doors and frames.

   b. Steel Through Bolts: For the following unless door blocking is provided:

      1) Surface hinges to doors.
      2) Closers to doors and frames.
      3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.15 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule or directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
3. Key Control System Software: Set up multiple-index system based on final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control and access devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Integrated Credential Readers and Entry Management: Ensure complete and correct operation.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. Each door to have the following: (Next Page)

Hardware Group No. 1
For use on Door #(s): 148A and 148B

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	TA2314	US10B	MK
1	EA	PANIC BAR & TRIM (FAIL SAFE)	33/35A & 89/99	US10B	VON
1	EA	SURFACE CLOSER	LDP-351	US10B	SA
1	EA	GASKETING	S88	BK	PMK
1	EA	POWER SUPPLY	CTE ENGAGE (POE)	LGR	SCE

DOOR NORMALLY CLOSED AND LOCKED.

Hardware Group No. 2
For use on Door #(s): 234A - PAIR

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	ELEC PANIC BAR	QEL9927EO	US10B	VON
1	EA	CARD READER	MTB SERIES	-	SCH
1	EA	POWER SUPPLY	CTE ENGAGE (POE)	-	SCH
-	-	SURFACE CLOSER	EXISTING	-	-

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL MOMENTARILY UNLOCK ELEC LOCK, ALLOWING ACCESS. DOOR UNLOCKS WITH LOSS OF POWER OR FROM REMOTE SIGNAL AT FIRE COMMAND CENTER . FREE EGRESS AT ALL TIMES.

Hardware Group No. 3
For use on Door #(s): 212A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELEC PANIC BAR	QEL9927EO	US10B	VON
1	EA	CARD READER	MTB SERIES	-	SCH
1	EA	ELEC STRIKE	SERIES 1500/1600	US10B	HS
1	EA	POWER SUPPLY	CTE ENGAGE (POE)	-	SCH
-	-	SURFACE CLOSER	EXISTING	-	-

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL MOMENTARILY UNLOCK ELEC LOCK, ALLOWING ACCESS. DOOR UNLOCKS WITH LOSS OF POWER OR FROM REMOTE SIGNAL AT FIRE COMMAND CENTER . FREE EGRESS AT ALL TIMES.

END OF SECTION 087100

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

    a. Steel.
    b. Galvanized metal.
    c. Aluminum (not anodized or otherwise coated).

2. Interior Substrates:

    a. Steel.
    b. Gypsum board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each coat of each Sample.
3. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. VOC content.

1.4 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**,** from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

1.9 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 unopened gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:

~~1. Behr Process Corporation.~~
2. Benjamin Moore & Co.
~~3. Corotech Coatings; Benjamin Moore & Co.~~
~~4. Devoe Paint Company; Akzo Nobel.~~
~~5. Dulux (formerly ICI Paints); a brand of AkzoNobel.~~
6. PPG Paints.
~~7. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.~~
8. Sherwin-Williams Company (The).
9. Tnemec Inc.

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

B. Colors: Selected by Architect from manufacturer’s full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report in writing conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Gypsum Board: 12 percent.

2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
~~3. Plaster Substrates: Verify that plaster is fully cured.~~

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants in accordance with SSPC-SP 1.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods in accordance with SSPC-SP 16 to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

G. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Coating supplier/manufacturer shall provide minimum 2 hours of technical service at jobsite at start-up of coating preparation and application.

B. During course of coating project, manufacturer’s rep shall be on site periodically to verify application is per manufacturer’s recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over Epoxy System:

a. Prime Coat: Epoxy, high-build, low gloss:

1) S-W Macropoxy 646, B58 Series, at 5.0 to 10 mils dry, per coat.

b. Intermediate Coat:

1) Polyurethane, two-component, pigmented, matching topcoat.

c. Topcoat: Polyurethane, two-component, pigmented, gloss:

1) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series, at 2.0 to 4.0 mils dry, per coat.

B. Galvanized-Metal Substrates:

1. Pigmented Polyurethane over Vinyl Wash Primer System:

a. Prime Coat: Primer, vinyl wash:

1) S-W DTM Wash Primer, B71Y1, at 0.7 to 1.3 mils dry, per coat.

b. First Topcoat:

1) Polyurethane, two-component, pigmented, matching topcoat.

c. Second Topcoat: Polyurethane, two-component, pigmented, gloss:

1) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series, at 2.0 to 4.0 mils dry, per coat.

C. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Pigmented Polyurethane System:

a. Prime Coat: Primer, vinyl wash:

1) S-W DTM Wash Primer, at 0.2 to 0.4 mils dry, per coat.

b. First Topcoat:

1) Polyurethane, two-component, pigmented, matching topcoat.

c. Second Topcoat: Polyurethane, two-component, pigmented, gloss:

1) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series, at 2.0 to 4.0 mils dry, per coat.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pre-Catalyzed Waterbased Epoxy System:

a. Prime Coat: Primer, rust-inhibitive, water based:

1) S-W Pro-Cryl Universal Primer, B66-310 Series, at 2.0 to 4.0 mils dry, per coat.

b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.

c. Topcoat: Epoxy-modified latex, interior, eggshell:

1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Eggshell, K45 Series, at 1.5 mils dry, per coat.

d. Topcoat: Epoxy-modified latex, interior, semi-gloss:

1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss, K46 Series, at 1.5 mils dry, per coat.

B. Factory Primed Doors and Frames:

1. Alkyd Enamel System:

a. Prime Coat: Universal primer:

1) Pro Industrial Pro-Cryl Universal Primer, B66 1300 Series, at 1.9 to 3.8 mils dry, per coat.

b. Topcoat: Alkyd enamel:

1) Direct-to-Metal Alkyd Enamel Semi-Gloss, B55-100 Series, at 3.0 to 5.6 mils dry, per coat.

C. Gypsum Board or Plaster Substrates:

1. Pre-Catalyzed Waterbased Epoxy System:

a. Prime Coat: Primer sealer, latex, interior:

1) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600, at 1.0 mils dry, per coat.

b. Intermediate Coat:

1) Light industrial coating, interior, water based, matching topcoat.

c. Topcoat: Epoxy-modified latex, interior, eggshell:

1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Eggshell, K45 Series, at 1.5 mils dry, per coat.

d. Topcoat: Epoxy-modified latex, interior, semi-gloss:

1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss, K46 Series, at 1.5 mils dry, per coat.

END OF SECTION 099600

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SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The Temperature Control Contractor (TCC) shall install, furnish, program, and turn over to client a complete operating DDC system for monitoring and controlling of MEP systems as shown in the Contract Documents.

B. Section Includes:

1. DDC system for monitoring and controlling of MEP systems.
2. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

C. Scope not included in 230923:

1. Electrical Contractor (EC) to provide all wiring to all motor starters, variable frequency drives, and motor control centers.
2. EC to provide 120 V/60 Hz power to all direct digital controllers (DDC) that require 120 V power.
3. Sheet Metal Contractor shall install all motorized dampers, duct mounted airflow measuring stations, thermowells (for temperature & pressure sensors), flow meters, control valves, and other accessories that are furnaced by the TCC.
4. Mechanical Contractor shall install all temperature and pressure sensing wells and control valves furnished by the Temperature Control Contactor.

1.2 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.

2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.

D. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.

J. DOCSIS: Data-Over Cable Service Interface Specifications.

K. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

L. HLC: Heavy load conditions.

M. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure,

and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

N. BACnet IP: Building Automation and Control Networks over internet protocol.

O. LAN: Local area network.

P. LNS: LonWorks Network Services.

Q. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

R. Modbus TCP/IP: An open protocol for exchange of process data.

S. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

T. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

U. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

V. PDA: Personal digital assistant.

W. Peer to Peer: Networking architecture that treats all network stations as equal partners.

X. RAM: Random access memory.

Y. RF: Radio frequency.

Z. Router: Device connecting two or more networks at network layer.

AA. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

BB. UPS: Uninterruptible power supply.

CC. USB: Universal Serial Bus.

DD. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

EE. VAV: Variable air volume.

FF. WLED: White light emitting diode.

1.3 ACTION SUBMITTALS

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

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation and maintenance instructions including factors effecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details where applicable.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail means of vibration isolation and show attachments to rotating equipment.
4. Plan Drawings indicating the following:

    a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
    b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
    c. Each desktop operator workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
    d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
    e. Network communication cable and raceway routing.
    f. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.

5. Schematic drawings for each controlled HVAC system indicating the following:

a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
c. A graphic showing location of control I/O in proper relationship to HVAC system.
d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
g. Narrative sequence of operation.
h. Graphic sequence of operation, showing all inputs and output logical blocks.

6. Control panel drawings indicating the following:

a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
c. Front, rear, and side elevations and nameplate legend.
d. Unique drawing for each panel.

7. DDC system network riser diagram indicating the following:

a. Each device connected to network with unique identification for each.
b. Interconnection of each different network in DDC system.
c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or fiber-optic cable type. Indicate raceway type and size for each.
d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

8. DDC system electrical power riser diagram indicating the following:

a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
d. Power wiring type and size, race type, and size for each.

9. Monitoring and control signal diagrams indicating the following:

    a. Control signal cable and wiring between controllers and I/O.
    b. Point-to-point schematic wiring diagrams for each product.
    c. Control signal tubing to sensors, switches and transmitters.
    d. Process signal tubing to sensors, switches and transmitters.

C. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:

    a. Loss of power.
    b. Loss of network communication signal.
    c. Loss of controller signals to inputs and outpoints.
    ~~d. Operator workstation failure.~~
    e. Gateway failure.
    f. Network failure
    g. Controller failure.
    h. Instrument failure.
    i. Control damper and valve actuator failure.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

D. Samples:

1. For each exposed product, installed in finished space for approval of selection of aesthetic characteristics.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings, reflected ceiling plan(s), and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Qualification Data:

1. Systems Provider Qualification Data:

    a. Resume of project manager assigned to Project.

b. Resumes of application engineering staff assigned to Project.
c. Resumes of installation and programming technicians assigned to Project.
d. Resumes of service technicians assigned to Project.
e. Brief description of past project including physical address, floor area, number of floors, building system cooling and heating capacity and building's primary function.
f. Description of past project DDC system, noting similarities to Project scope and complexity indicated.
g. Names of staff assigned to past project that will also be assigned to execute work of this Project.
h. Owner contact information for past project including name, phone number, and e-mail address.
i. Contractor contact information for past project including name, phone number, and e-mail address.
j. Architect and Engineer contact information for past project including name, phone number, and e-mail address.

2. Manufacturer's qualification data.
3. Testing agency's qualifications data.

C. Welding certificates.

D. Product Certificates:

1. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135.

E. Product Test Reports: For each product that requires testing to be performed by manufacturer.

F. Preconstruction Test Reports: For each separate test performed.

G. Source quality-control reports.

H. Field quality-control reports.

I. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to:

    1) Design and install new points, panels, and other hardware.
    2) Perform preventive maintenance and calibration.
    3) Debug hardware problems.
    4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.
n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.6 QUALITY ASSURANCE

A. DDC System Manufacturer Qualifications:

1. Nationally recognized manufacturer of DDC systems and products.
2. DDC systems with similar requirements to those indicated for a continuous period of 5 years within time of bid.

3. DDC systems and products that have been successfully tested and in use on at least 3 past projects.
4. Having complete published catalog literature, installation, operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing and quality control.
    d. Technical support for DDC system installation training, commissioning and troubleshooting of installations.
    e. Owner operator training.

6. TCC to provide Niagara Framework (Tridium) automation system.
7. Acceptable Control Supplier:

    a. Alerton.
    b. Honeywell.
    c. KMC Controls.
    d. Delta Controls.

8. Acceptable Control Installation and Service Contractor:

    a. Open Control System.
    b. Innovative Control Systems, LLC.
    c. Approved equivalent contractors.

B. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, DDC system manufacturer.
2. In-place facility located within 150 miles of Project and be capable of to respond on-site within 4 hours of notice.
3. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
4. Service and maintenance staff assigned to support Project during warranty period.
5. Product parts inventory to support on-going DDC system operation for a period of not less than 5 years after Substantial Completion.
6. DDC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
4. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

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

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period at no cost to client.

1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.

a. Install updates only after receiving Owner's written authorization.

3. Warranty service shall occur during normal business hours and commence within 24 hours of Owner's warranty service request.
4. Warranty Period: 3 years from date of Substantial Completion. Warranty shall cover labor, material, replacement, and repairs for work performed during warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Alerton.
B. Honeywell.
C. KMC Controls.
D. Delta Controls.

2.2 DDC SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated

based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.

1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.

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

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated.

1. System Performance Objectives:

a. DDC system shall manage HVAC systems.
b. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
c. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
d. DDC system shall operate while unattended by an operator and through operator interaction.
e. DDC system shall record & store trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.

B. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths shall comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. DDC System Data Storage:

1. Include server(s) with disk drive data storage to archive not less than 24 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
2. When logged onto a server, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.

3. Server(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
4. Server(s) shall use IT industry-standard database platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE).

D. Future Expandability:

1. DDC system size shall be expandable to an ultimate capacity of at least **120%** times total I/O points indicated.
2. Additional DDC controllers, I/O and associated wiring shall be all that is needed to achieve ultimate capacity. Initial network infrastructure shall be designed and installed to support ultimate capacity.
3. Operator interfaces installed initially shall not require hardware and software additions and revisions for ultimate capacity.

E. Environmental Conditions for Controllers, Gateways, and Routers:

1. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location.

    a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.

2. Products shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Products not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:

    a. Outdoors, Protected: Type 4.
    b. Outdoors, Unprotected: Type 4.
    c. Indoors, Heated with Filtered Ventilation: Type 2.
    d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
    e. Indoors, Heated and Air Conditioned: Type 2.
    f. Mechanical Equipment Rooms:

        1) Chiller and Boiler Rooms: Type 4.
        2) Air-Moving Equipment Rooms: Type 4.

    g. Localized Areas Exposed to Washdown: Type 4.
    h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 3.

i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
j. Hazardous Locations: Explosion-proof rating for condition.

F. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated and ventilated as required by instrument and application.

2. Instruments, actuators and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments and actuators not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:

a. Outdoors, Protected: Type 4.
b. Outdoors, Unprotected: Type 4.
c. Indoors, Heated with Filtered Ventilation: Type 2.
d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
e. Indoors, Heated and Air Conditioned: Type 2.
f. Mechanical Equipment Rooms:

1) Chiller and Boiler Rooms: Type 4.
2) Air-Moving Equipment Rooms: Type 4.

g. Localized Areas Exposed to Washdown: Type 4.
h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 3.
i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
j. Hazardous Locations: Explosion-proof rating for condition.

G. Electric Power Quality:

1. Power-Line Surges:

a. Protect DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.
b. Do not use fuses for surge protection.

c. Test protection in the normal mode and in the common mode, using the following two waveforms:

1) 10-by-1000-mic.sec. waveform with a peak voltage of 1500 V and a peak current of 60 A.
2) 8-by-20-mic.sec. waveform with a peak voltage of 1000 V and a peak current of 500 A.

2. Power Conditioning:

a. Protect DDC system products connected to ac power circuits from irregularities and noise rejection. Characteristics of power-line conditioner shall be as follows:

1) At 85 percent load, output voltage shall not deviate by more than plus or minus 1 percent of nominal when input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
2) During load changes from zero to full load, output voltage shall not deviate by more than plus or minus 3 percent of nominal.
3) Accomplish full correction of load switching disturbances within five cycles, and 95 percent correction within two cycles of onset of disturbance.
4) Total harmonic distortion shall not exceed 3-1/2 percent at full load.

3. Ground Fault: Protect products from ground fault by providing suitable grounding. Products shall not fail due to ground fault condition.

H. Backup Power Source:

1. HVAC systems and equipment served by a backup power source shall have associated DDC system products that control such systems and equipment also served from a backup power source.

I. UPS:

1. DDC system products powered by UPS units shall include the following:

~~**a. Desktop operator workstations.**~~
~~**b. Printers.**~~
c. Servers.
d. Gateways.
e. DDC controllers.

2. DDC system instruments and actuators powered by UPS units shall be defined in the documents.

J. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.4 SYSTEM ARCHITECTURE

A. System architecture shall consist of no more than 3 levels of LANs.

1. Level one LAN shall connect network controllers and operator workstations.
2. Level two LAN shall connect programmable application controllers to other programmable application controllers, and to network controllers.
3. Level three LAN shall connect application-specific controllers to programmable application controllers and network controllers.
4. Level three LAN shall connect application-specific controllers to application-specific controllers.

B. DDC system shall consist of dedicated and/or separated LANs that are not shared with other building systems and tenant data and communication networks.

C. System architecture shall be modular and have inherent ability to expand to not less than 3 times system size indicated with no impact to performance indicated.

D. System architecture shall perform modifications without having to remove and replace existing network equipment.

E. Number of LANs and associated communication shall be transparent to operator. All I/O points residing on any LAN shall be capable of global sharing between all system LANs.

F. System design shall eliminate dependence on any single device for system alarm reporting and control execution. Each controller shall operate independently by performing its' own control, alarm management and historical data collection.

G. Special Network Architecture Requirements:

1. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units connected directly to controller that is controlling air-handling system air-handling unit(s). Basically, create a DDC system LAN that aligns with air-handling system being controlled.

2.5 DDC SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access: Operator shall be able to access entire DDC system through any of multiple means, including, but not limited to, the following:

1. Desktop and portable operator workstation with hardwired connection through LAN port.
2. Portable operator terminal with hardwired connection through LAN port.
3. Portable operator workstation with wireless connection through LAN router.
4. Remote connection using outside of system personal computer or through Web access.
5. Remote connection using portable operator workstation and internet connection.
6. Mobile device.

B. Access to system, regardless of operator means used, shall be transparent to operator.

C. Desktop Workstations:

1. Connect to DDC system Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
2. Able to communicate with any device located on any DDC system LAN.
3. Able to communicate, with modems, remotely with any device connected to any DDC system LAN.
4. Communication via a modem shall not interfere with LAN activity and LAN activity shall not prevent workstation from handling incoming calls.

D. Critical Alarm Reporting:

1. Operator-selected critical alarms shall be sent by DDC system to notify operator of critical alarms that require immediate attention.
2. DDC system shall send alarm notification to multiple recipients that are assigned for each alarm.
3. DDC system shall notify recipients by any or all means, including e-mail, text message, and prerecorded phone message to mobile and landline phone numbers.

E. Simultaneous Operator Use: Capable of accommodating up to 10 simultaneous operators that are accessing DDC system through any one of operator interfaces indicated.

2.6 NETWORK COMMUNICATION PROTOCOL

A. Network communication protocol(s) used throughout entire DDC system shall be open to public and available to other companies for use in making future modifications to DDC system.

B. ASHRAE 135 Protocol:

1. ASHRAE 135 communication protocol shall be sole and native protocol used throughout entire DDC system.
2. DDC system shall not require use of gateways except to integrate HVAC equipment and other building systems and equipment, not required to use ASHRAE 135 communication protocol.
3. If used, gateways shall connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
4. Operator workstations, controllers and other network devices shall be tested and listed by BACnet Testing Laboratories.

~~**2.7 DESKTOP OPERATOR WORKSTATIONS**~~

~~**A. Performance Requirements:**~~

~~**1. Performance requirements may dictate equipment exceeding minimum requirements indicated.**~~
~~**2. Energy Star compliant.**~~

~~**B. Computer Workstation:**~~

~~**1. Shall include computer, monitor(s), mouse, and keyboard.**~~

~~**a. Computer shall support all building automation operations, email, include all Microsoft Office suit programs, and pdf viewer and edit program.**~~

~~**1) Shall be a minimum i5 processor with 16 GB RAM and 3.6 GHz processor.**~~
~~**2) 64-bit.**~~
~~**3) Capable of expanding ram to 32 GB.**~~
~~**4) 1 TB hard drive.**~~
~~**5) 2 USB ports, no optical drive required.**~~
~~**6) 2 USB c ports.**~~
~~**7) Graphics card suitable for BAS requirements.**~~
~~**8) Sound card.**~~
~~**9) Network card and built in wireless.**~~
~~**10) Windows 10 or newer.**~~

2.8 ASHRAE 135 GATEWAYS

A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable. BACnet-controlled plant equipment includes, but is not limited to, boilers, chillers, and variable-speed drives.

B. Include gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment, only when specifically requested and approved by Owner.

C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.

D. Gateway Minimum Requirements:

1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.
2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs according to ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
6. Backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.9 DDC CONTROLLERS

A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.

C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.

E. Environment Requirements:

1. Controller hardware shall be suitable for the anticipated ambient conditions.
2. Controllers located in conditioned space shall be rated for operation at 32 to 120 deg F.
3. Controllers located outdoors shall be rated for operation at 40 to 150 deg F.

F. Power and Noise Immunity:

1. Controller shall operate at 90 to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent of nominal voltage.
2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

G. DDC Controller Spare Processing Capacity:

1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:

    a. Network Controllers: 50 percent.
    b. Programmable Application Controllers: Not less than 60 percent.
    c. Application-Specific Controllers: Not less than 70 percent.

2. Memory shall support DDC controller's operating system and database and shall include the following:

    a. Monitoring and control.
    b. Energy management, operation and optimization applications.
    c. Alarm management.
    d. Historical trend data of all connected I/O points.
    e. Maintenance applications.
    f. Operator interfaces.
    g. Monitoring of manual overrides.

H. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

I. Input and Output Point Interface:

1. Hardwired input and output points shall connect to network, programmable application and application-specific controllers.
2. Input and output points shall be protected so shorting of point to itself, to another point, or to ground will not damage controller.
3. Input and output points shall be protected from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:

a. AIs shall include monitoring of low-voltage (zero- to 10-V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
b. AIs shall be compatible with, and field configurable to, sensor and transmitters installed.
c. Controller AIs shall perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
d. Signal conditioning including transient rejection shall be provided for each AI.
e. Capable of being individually calibrated for zero and span.
f. Incorporate common-mode noise rejection of at least 50 dB from zero to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.

5. AOs:

a. Controller AOs shall perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
b. Output signals shall have a range of 4 to 20 mA dc or zero- to 10-V dc as required to include proper control of output device.
c. Capable of being individually calibrated for zero and span.
d. AOs shall not exhibit a drift of greater than 0.4 percent of range per year.

6. BIs:

a. Controller BIs shall accept contact closures and shall ignore transients of less than 5-ms duration.
b. Isolation and protection against an applied steady-state voltage of up to 180-V ac peak.
c. BIs shall include a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against effects of contact bounce and noise.
d. BIs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
e. Pulse accumulation input points shall comply with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Buffer shall be provided to totalize pulses. Pulse accumulator shall accept rates of at least 20 pulses per second. The totalized value shall be reset to zero on operator's command.

7. BOs:

a. Controller BOs shall include relay contact closures or triac outputs for momentary and maintained operation of output devices.

1) Relay contact closures shall have a minimum duration of 0.1 second. Relays shall include at least 180 V of isolation. Electromagnetic interference suppression shall be provided on all output lines to limit transients to non-damaging levels. Minimum contact rating shall be 1 A at 24-V ac.
2) Triac outputs shall include at least 180 V of isolation. Minimum contact rating shall be 1 A at 24-V ac.

b. BOs shall include for two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
c. BOs shall be selectable for either normally open or normally closed operation.
d. Include tristate outputs (two coordinated BOs) for control of three-point floating-type electronic actuators without feedback.
e. Limit use of three-point floating devices to VAV terminal unit control applications, and other applications indicated on Drawings, Control algorithms shall operate actuator to one end of its stroke once every 24 hours for verification of operator tracking.

2.10 NETWORK CONTROLLERS

A. General Network Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. System shall consist of one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Controller shall have enough memory to support its operating system, database, and programming requirements.
4. Data shall be shared between networked controllers and other network devices.
5. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Controllers that perform scheduling shall have a real-time clock.
7. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
8. Controllers shall be fully programmable.

B. Communication:

1. Network controllers shall communicate with other devices on DDC system network.
2. Network controller also shall perform routing if connected to a network of programmable application and application-specific controllers.

C. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation.
2. ~~**Local Keypad and Display:**~~

   a. ~~**Equip controller with local keypad and digital display for interrogating and editing data.**~~
   b. ~~**Use of keypad and display shall require security password.**~~

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 72 hours.

2.11 PROGRAMMABLE APPLICATION CONTROLLERS

A. General Programmable Application Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. Controller shall have enough memory to support its operating system, database, and programming requirements.
3. Data shall be shared between networked controllers and other network devices.
4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
7. Controllers shall be fully programmable.

B. Communication:

1. Programmable application controllers shall communicate with other devices on network.

C. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation.
2. ~~**Local Keypad and Display:**~~

   a. ~~**Equip controller with local keypad and digital display for interrogating and editing data.**~~

~~b. Use of keypad and display shall require security password.~~

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 72 hours.

2.12 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.

1. Capable of standalone operation and shall continue to include control functions without being connected to network.
2. Data shall be shared between networked controllers and other network devices.

B. Communication: Application-specific controllers shall communicate with other application-specific controller and devices on network, and to programmable application and network controllers.

C. Operator Interface: Controller shall be equipped with a service communications port for connection to a portable operator's workstation. Connection shall extend to port on space temperature sensor that is connected to controller.

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.13 CONTROLLER SOFTWARE

A. General Controller Software Requirements:

1. Software applications shall reside and operate in controllers. Editing of applications shall occur at operator workstations.

2. I/O points shall be identified by a character point name. Same names shall be used at operator workstations.
3. Control functions shall be executed within controllers using DDC algorithms.
4. Controllers shall be configured to use stored default values to ensure fail-safe operation. Default values shall be used when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Operator access shall be secured using individual security passwords and user names.
2. Passwords shall restrict operator to points, applications, and system functions as assigned by system manager.
3. Operator log-on and log-off attempts shall be recorded.
4. System shall protect itself from unauthorized use by automatically logging off after last keystroke. The delay time shall be operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule shall consist of the following:

1. Weekly Schedule:

a. Include separate schedules for each day of week.
b. Each schedule should include the capability for start, stop, optimal start, optimal stop, and night economizer.
c. Each schedule may consist of up to 10 events.
d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:

a. Include ability for operator to designate any day of the year as an exception schedule.
b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.

3. Holiday Schedules:

a. Include capability for operator to define up to 99 special or holiday schedules.
b. Schedules may be placed on scheduling calendar and will be repeated each year.
c. Operator shall be able to define length of each holiday period.

D. System Coordination:

1. Include standard application for proper coordination of equipment.

2. Application shall include operator with a method of grouping together equipment based on function and location.
3. Group may then be used for scheduling and other applications.

E. Binary Alarms:

1. Each binary point shall be set to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:

1. Each analog object shall have both high and low alarm limits.
2. Alarming shall be able to be automatically and manually disabled.

G. Alarm Reporting:

1. Operator shall be able to determine action to be taken in event of an alarm.
2. Alarms shall be routed to appropriate operator workstations based on time and other conditions.
3. Alarm shall be able to start programs, print, be logged in event log, generate custom messages, and display graphics.

H. Remote Communication:

1. System shall have ability to dial out in the event of an alarm.

I. Electric Power Demand Limiting:

1. Demand-limiting program shall monitor building or other operator-defined electric power consumption from signals connected to electric power meter or from a watt transducer or current transformer.
2. Demand-limiting program shall predict probable power demand such that action can be taken to prevent exceeding demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
3. Demand reduction shall be accomplished by the following means:

    a. Reset air-handling unit supply temperature set points.
    b. Reset space temperature set points.
    c. De-energize equipment based on priority.

4. Demand-limiting parameters, frequency of calculations, time intervals, and other relevant variables shall be based on the means by which electric power service provider computes demand charges.
5. Include demand-limiting prediction and control for any individual meter monitored by system or for total of any combination of meters.
6. Include means operator to make the following changes online:

a. Addition and deletion of loads controlled.
b. Changes in demand intervals.
c. Changes in demand limit for meter(s).
d. Maximum shutoff time for equipment.
e. Minimum shutoff time for equipment.
f. Select rotational or sequential shedding and restoring.
g. Shed and restore priority.

7. Include the following information and reports, to be available on an hourly, daily, weekly, monthly and annual basis:

a. Total electric consumption.
b. Peak demand.
c. Date and time of peak demand.
d. Daily peak demand.

J. Maintenance Management: System shall monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.

K. Sequencing: Include application software based on sequences of operation indicated to properly sequence chillers, boilers, and other applicable HVAC equipment.

L. Control Loops:

1. Support any of the following control loops, as applicable to control required:

a. Two-position (on/off, open/close, slow/fast) control.
b. Proportional control.
c. Proportional plus integral (PI) control.
d. Proportional plus integral plus derivative (PID) control.

1) Include PID algorithms with direct or reverse action and anti-windup.
2) Algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs.
3) Controlled variable, set point, and PID gains shall be operator-selectable.

e. Adaptive (automatic tuning).

M. Staggered Start: Application shall prevent all controlled equipment from simultaneously restarting after a power outage. Order which equipment (or groups of equipment) is started, along with the time delay between starts, shall be operator-selectable.

N. Energy Calculations:

1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.

2. Include an algorithm that calculates a sliding-window average (rolling average). Algorithm shall be flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
3. Include an algorithm that calculates a fixed-window average. A digital input signal shall define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.

O. Anti-Short Cycling:

1. BO points shall be protected from short cycling.
2. Feature shall allow minimum on-time and off-time to be selected.

P. On and Off Control with Differential:

1. Include an algorithm that allows a BO to be cycled based on a controlled variable and set point.
2. Algorithm shall be direct- or reverse-acting and incorporate an adjustable differential.

Q. Run-Time Totalization:

1. Include software to totalize run-times for all BI and BO points.
2. A high run-time alarm shall be assigned, if required, by operator.

2.14 ENCLOSURES

A. General Enclosure Requirements:

1. House each controller and associated control accessories in a enclosure. Enclosure shall serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies and transformers.
2. Do not house more than one controller in a single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
5. Individual wall-mounted single-door enclosures shall not exceed 36 inches wide and 48 inches high.
6. Individual wall-mounted double-door enclosures shall not exceed 60 inches wide and 36 inches high.
7. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
8. Supply each enclosure with a complete set of as-built schematics, tubing, and wiring diagrams and product literature located in a pocket on inside of door.

B. Internal Arrangement:

1. Internal layout of enclosure shall group and protect pneumatic, electric, and electronic components associated with a controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 25 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install a maximum of two wires on each side of a terminal.
9. Include enclosure field power supply with a toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with a line-voltage nominal 20-A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with a 5-A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).
12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). The nameplates shall have at least 1/4-inch-high lettering.
13. Route tubing cable and wire located inside enclosure within a raceway with a continuous removable cover.
14. Label each end of cable, wire and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 25 percent spare area on face of panel.

C. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.

D. Wall-Mounted, NEMA 250, Type 1:

1. Enclosure shall be NRTL listed according to UL 50 or UL 50E.
2. Construct enclosure of steel.

3. Finish enclosure inside and out with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior color shall be NSF/ANSI 61 gray or manufacturer's standard.
    b. Interior color shall be NSF/ANSI 61 gray or manufacturer's standard.

4. Hinged door full size of front face of enclosure and supported using:

    a. Enclosures sizes less than 36 in. tall: Multiple butt hinges.
    b. Enclosures sizes 36 in. tall and larger: Continuous piano hinges.

5. Removable internal panel with a white polyester powder coating that is electrostatically applied and then baked to bond to substrate.
6. Internal panel mounting hardware, grounding hardware and sealing washers.
7. Grounding stud on enclosure body.
8. Thermoplastic pocket on inside of door for record Drawings and Product Data.

E. Wall Mounted NEMA 250, Types 4 and 12:

1. Enclosure shall be NRTL listed according to UL 508A.
2. Seam and joints are continuously welded and ground smooth.
3. Where recessed enclosures are indicated, include enclosures with face flange for flush mounting.
4. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
5. Single-door enclosure sizes up to 60 inches tall by 36 inches wide.
6. Double-door enclosure sizes up to 36 inches tall by 60 inches wide.
7. Construct enclosure of steel.
8. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior color shall be NSF/ANSI 61 gray or manufacturer's standard.
    b. Interior color shall be NSF/ANSI 61 gray or manufacturer's standard.

9. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.

    a. Sizes through 24 Inches Tall: Two hinges.
    b. Sizes between 24 Inches through 48 Inches Tall: Three hinges.
    c. Sizes Larger 48 Inches Tall: Four hinges.

10. Double-door enclosures with overlapping door design to include unobstructed full-width access.

    a. Single-door enclosures 48 inches and taller, and all double-door enclosures, with three-point (top, middle and bottom) latch system.

11. Removable internal panel with a white polyester powder coating that is electrostatically applied and then baked to bond to substrate.
12. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
13. Grounding stud on enclosure body.
14. Thermoplastic pocket on inside of door for record Drawings and Product Data.

F. Accessories:

1. Electric Heater:

   a. Aluminum housing with brushed finish.
   b. Thermostatic control with adjustable set point from zero to 100 deg F.
   c. Capacity: 100, 200, 400, and 800 W as required by application.
   d. Fan draws cool air from bottom of enclosure and passes air across thermostat and heating elements before being released into enclosure cavity. Heated air is discharged through the top of heater.

2. Ventilation Fans, Filtered Intake and Exhaust Grilles:

   a. Number and size of fans, filters and grilles as required by application.
   b. Compact cooling fans engineered for 50,000 hours of continuous operation without lubrication or service.
   c. Fans capable of being installed on any surface and in any position within enclosure for spot cooling or air circulation.
   d. Thermostatic control with adjustable set point from 32 to 140 deg F.
   e. Airflow Capacity at Zero Pressure:

      1) 4-Inch Fan: 100 cfm.
      2) 6-Inch Fan: 240 cfm.
      3) 10-Inch Fan: 560 cfm.

   f. Maximum operating temperature of 158 deg F.
   g. 4-inch fan thermally protected and provided with permanently lubricated ball-bearings.
   h. 6- and 10-inch fans with ball-bearing construction and split capacitor motors thermally protected to avoid premature failure.
   i. Dynamically balanced impellers molded from polycarbonate material.
   j. Fan furnished with power cord and polarized plug for power connection.
   k. Fan brackets, finger guards and mounting hardware provided with fans to complete installation.
   l. Removable Intake and Exhaust Grilles: Stainless steel of size to match fan size and suitable for NEMA 250, Types 1 and 12 enclosures.
   m. Filters for NEMA 250, Type 1 Enclosures: Washable aluminum, of a size to match intake grille.
   n. Filters for NEMA 250, Type 12 Enclosures: Disposable, of a size to match intake grille.

3. Bar handle with keyed cylinder lock set.

2.15 RELAYS

A. General-Purpose Relays:

1. Relays shall be heavy duty and rated for at least 10 A at 250-V ac and 60 Hz.
2. Relays shall be either double pole double throw (DPDT) or three-pole double throw, depending on the control application.
3. Use a plug-in-style relay with an eight-pin octal plug for DPDT relays and an 11-pin octal plug for three-pole double-throw relays.
4. Construct the contacts of either silver cadmium oxide or gold.
5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
6. Relays shall have LED indication and a manual reset and push-to-test button.
7. Equip relays with coil transient suppression to limit transients to non-damaging levels.
8. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
9. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

B. Multifunction Time-Delay Relays:

1. Relays shall be continuous duty and rated for at least 10 A at 240-V ac and 60 Hz.
2. Relays shall be DPDT relay with up to eight programmable functions to provide on/off delay, interval and recycle timing functions.
3. Use a plug-in-style relay with either an 8- or 11-pin octal plug.
4. Construct the contacts of either silver cadmium oxide or gold.
5. Enclose the relay in a dust-tight cover.
6. Include knob and dial scale for setting delay time.
7. Equip relays with coil transient suppression to limit transients to non-damaging levels.
8. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
9. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

C. Latching Relays:

1. Relays shall be continuous duty and rated for at least 10 A at 250-V ac and 60 Hz.
2. Relays shall be either DPDT or three-pole double throw, depending on the control application.
3. Use a plug-in-style relay with a multibladed plug.
4. Construct the contacts of either silver cadmium oxide or gold.

5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
6. Equip relays with coil transient suppression to limit transients to non-damaging levels.
7. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
8. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

D. Current Sensing Relay:

1. Monitors ac current.
2. Independent adjustable controls for pickup and dropout current.
3. Energized when supply voltage is present and current is above pickup setting.
4. De-energizes when monitored current is below dropout current.
5. Dropout current is adjustable from 50 to 95 percent of pickup current.
6. Include a current transformer, if required for application.
7. House current sensing relay and current transformer in its own enclosure. Use NEMA 250, Type 12 enclosure for indoors and NEMA 250, Type 4 for outdoors.

E. Combination On-Off Status Sensor and On-Off Relay:

1. Description:

   a. On-off control and status indication in a single device.
   b. LED status indication of activated relay and current trigger.
   c. Closed-Open-Auto override switch located on the load side of the relay.

2. Performance:

   a. Ambient Temperature: Minus 30 to 140 deg F.
   b. Voltage Rating: Single-phase loads rated for 300-V ac. Three-phase loads rated for 600-V ac.

3. Status Indication:

   a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
   b. Current Sensor Range: As required by application.
   c. Current Set Point: Fixed or adjustable as required by application.
   d. Current Sensor Output:

      1) Solid-state, single-pole double-throw contact rated for 30-V ac and dc and for 0.4 A.
      2) Solid-state, single-pole double-throw contact rated for 120-V ac and 1.0 A.
      3) Analog, zero- to 5- or 10-V dc.
      4) Analog, 4 to 20 mA, loop powered.

4. Relay: Single-pole double-throw, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure.

2.16 ELECTRICAL POWER DEVICES

A. Transformers:

1. Transformer shall be sized for the total connected load, plus an additional 25 percent of connected load.
2. Transformer shall be at least 100 VA.
3. Transformer shall have both primary and secondary fuses.

B. DC Power Supply:

1. Plug-in style suitable for mating with a standard eight-pin octal socket. Include the power supply with a mating mounting socket.
2. Enclose circuitry in a housing.
3. Include both line and load regulation to ensure a stable output. To protect both the power supply and the load, power supply shall have an automatic current limiting circuit.
4. Performance:

    a. Output voltage nominally 25-V dc within 5 percent.
    b. Output current up to 100 mA.
    c. Input voltage nominally 120-V ac, 60 Hz.
    d. Load regulation within 0.5 percent from zero- to 100-mA load.
    e. Line regulation within 0.5 percent at a 100-mA load for a 10 percent line change.
    f. Stability within 0.1 percent of rated volts for 24 hours after a 20-minute warmup.

2.17 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. 250 through 1000 VA:

1. UPS units shall provide continuous, regulated output power without using their batteries during brown-out, surge, and spike conditions.
2. Load served shall not exceed 75 percent of UPS rated capacity, including power factor of connected loads.

    a. Larger-capacity units shall be provided for systems with larger connected loads.
    b. UPS shall provide 5 minutes of battery power.

3. Performance:

a. Input Voltage: Single phase, 120- or 230-V ac, compatible with field power source.
b. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
c. Output Voltage: 101- to 132-V ac, while input voltage varies between 89 and 152-V ac.
d. On Battery Output Voltage: Sine wave.
e. Inverter overload capacity shall be minimum 150 percent for 30 seconds.
f. Recharge time shall be a maximum of six hours to 90 percent capacity after full discharge to cutoff.
g. Transfer Time: 6 ms.
h. Surge Voltage Withstand Capacity: IEEE C62.41, Categories A and B; 6 kV/200 and 500 A; 100-kHz ringwave.

4. UPS shall be automatic during fault or overload conditions.
5. Unit with integral line-interactive, power condition topology to eliminate all power contaminants.
6. Include front panel with power switch and visual indication of power, battery, fault and temperature.
7. Unit shall include an audible alarm of faults and front panel silence feature.
8. Unit with four NEMA WD 1, NEMA WD 6 Configuration 5-15R receptacles.
9. UPS shall include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect the points to the DDC system.
10. Batteries shall be sealed lead-acid type and be maintenance free. Battery replacement shall be front accessible by user without dropping load.
11. Include tower models installed in ventilated cabinets to the particular installation location.

B. 1000 through 3000 VA:

1. UPS units shall provide continuous, regulated output power without using their batteries during brown-out, surge, and spike conditions.
2. Load served shall not exceed 75 percent of UPS rated capacity, including power factor of connected loads.

a. Larger-capacity units, or multiple units, shall be provided for systems with larger connected loads.
b. UPS shall provide 5 minutes of battery power.

3. Performance:

a. Input Voltage: Single phase, 120-V ac, plus 20 to minus 30 percent.
b. Power Factor: Minimum 0.97 at full load.
c. Output Voltage: Single phase, 120-V ac, within 3 percent, steady state with rated output current of 10.0 A, 30.0-A peak.
d. Inverter overload capacity shall be minimum 150 percent for 30 seconds.
e. Recharge time shall be a maximum of eight hours to 90 percent capacity.

4. UPS bypass shall be automatic during fault or overload conditions.
5. UPS shall include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect the points to the DDC system.
6. Batteries shall be sealed lead-acid type and be maintenance free.
7. Include tower models installed in ventilated cabinets or rack models installed on matching racks, as applicable to the particular installation location and space availability/configuration.

2.18 PIPING AND TUBING

A. Pneumatic, and Pressure Instrument Signal Air, Tubing and Piping:

1. Products in this paragraph are intended for use with the following:

   a. Main air and signal air to pneumatically controlled instruments, actuators and other control devices and accessories.
   b. Signal air between pressure instruments, such as sensors, switches, transmitters, controllers, and accessories.

2. Polyethylene Tubing:

   a. Fire-resistant black virgin polyethylene according to ASTM D 1248, Type 1, Class C and Grade 5.
   b. Tubing shall comply with stress crack test according to ASTM D 1693.
   c. Diameter, as required by application, of not less than nominal 0.25 inch.

3. Polyethylene Tubing Connectors and Fittings:

   a. Brass, barbered fittings and compression type.

2.19 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.

1. Wire size shall be at least No. 14 AWG or sized per length of run.
2. Conductor shall be 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
3. Conductor insulation shall be 600 V, Type THWN or Type THHN, and 90 deg C according to UL 83.
4. Conductor colors shall be black (hot), white (neutral), and green (ground).
5. Furnish wire on spools.

B. Single Twisted Shielded Instrumentation Cable above 24 V:

1. Wire size shall be a minimum No. 18 AWG or sized per length of run.

2. Conductors shall be a twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor insulation shall have a Type THHN/THWN or Type TFN rating.
4. Shielding shall be 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 600-V, 90-deg C rating and shall be Type TC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

C. Single Twisted Shielded Instrumentation Cable 24 V and Less:

1. Wire size shall be a minimum No. 18 AWG or sized per length of run.
2. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
3. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Cable shall be plenum rated.
2. Cable shall comply with NFPA 70.
3. Cable shall have a unique color that is different from other cables used on Project.
4. Copper Cable for Ethernet Network:

    a. 100BASE-TX, 1000BASE-T, or 1000BASE-TX.
    b. TIA/EIA 586, **Category 6 or Category 6A.**
    c. Minimum No. 22 AWG solid or sized per length of run.
    d. Shielded Twisted Pair (STP).
    e. Thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, Class CMP as plenum rated.

2.20 RACEWAYS FOR CONTROL WIRING, CABLING, AND TUBING

A. Metal Conduits, Tubing, and Fittings:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. EMT: Comply with NEMA ANSI C80.3 and UL 797.
3. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.21 CONTROL POWER WIRING AND RACEWAYS

A. Installation minimum requirements:

1. Mechanical spaces, services spaces, and areas without ceiling: All wiring including cables in EMT.
2. Space sensors and alarms: All wiring cables in EMT within wall construction.
3. Ducted ceiling return: Approved non-plenum cable.
4. Non-ducted return ceiling plenum: Approved plenum rated cable.
5. Non-accessible ceilings: EMT or code compliant equal solid conduit.
6. Inside air handling units: All wiring including cables in EMT or code compliant solid conduit.
7. Note the use of cable is limited to low voltage service with less than 24 volt only.
8. Do not lay cables on ceiling grids.
9. Conduit junctions and terminations shall utilize compression fittings.

B. All control wiring that is stated to be routed in EMT shall be separate from any power wiring.

2.22 FIELD EQUIPMENT

A. Space Sensors:

1. All space sensors to have digital display of setpoint and actual space temperature.
2. Set-point adjustment to be a maximum plus and minus 5 degrees from the null setpoint programmed through the DDC system.
3. Space sensors may be (RTD) 1,000 Ohm platinum with an accuracy of ±0.5 deg F or 10,000 OHM thermistor with accuracy of ±0.5 deg. F for all spaces.
4. Space sensor shall be manufacture’s standard color.

5. Provide insulating bases for all sensors located on exterior walls and on exterior column wraps. Foam seal cavity and junction box prior to installing insulating base.
6. Space sensors with occupant set-point adjustment shall be adjustable from the operator's workstation as to the deadband of adjustability allowed to the occupants.

B. Temperature Sensors:

1. Duct sensors for critical spaces shall utilize averaging elements, 1000 OHM platinum Resistance Temperature Detectors (RTD) having an accuracy of ±0.5 deg F.
2. Duct sensors for non-critical spaces may utilize 10,000 OHM or 20,000 OHM thermistor having an accuracy of ±1.0 deg F. 1000 OHM RTDs are also acceptable for non-critical applications.
3. Immersion sensors to be furnished with companion wells separable stainless steel. Well pressure rating shall be consistent with and extend the system pressure it will be immersed in. Wells shall withstand pipe design flow velocities.

C. Low limit thermostats:

1. Low limit safety thermostats shall be manually reset, line voltage with maximum 23'-0" flexible sensing elements responsible to lowest temperature along entire length. Furnish minimum two (2) wired in series on the discharge side of the first hydronic coils (i.e., a 4-section coil requires eight low limit thermostats wired in series). Contractor to note that the operating head of such instruments shall be shielded from conditions whereby it could be activated by low temperature.
2. All flexible averaging sensors shall be attached by wire ties to a suspended wire or insulated cable to prevent sensor contact with metal or other unit components.
3. Install flexible sensors across all coils at a maximum of 6" from the bottom of the bottom coil and a minimum of 7" diameter to turn the sensor. Install the detector with a maximum free distance of 12" between each pass.
4. Staggered coils (if applicable) shall utilize multiple sensors. Each sensor shall cover one section of the staggered coil. Sensing elements shall be a minimum of 17' long.
5. All flexible sensors shall be protected at point of penetration of unit via a section of poly tubing to prevent contact of the sensor and the unit.
6. Mount detector within 6" of the face of the coil unless noted otherwise. For staggered coil banks, this requirement applies for each half of the bank
7. TCC to note that when any low limit controls are above an elevation 7'-0" above floor level or otherwise inaccessible, they shall employ automatic reset and shall be wired to an auxiliary control panel of a 5'-0" elevation. The control panel with piano hinged door shall utilize a latching reset relay for each individual low limit control which ensures that the fan is de-energized even as the low limit resets automatically. The panel face shall utilize a red alarm pilot light that remains lit until the 10 second time delay reset relay momentary contact switch is activated. An LED inside the panel shall indicate which of low limits has signaled the alarm.

D. Electronic Actuators:

1. Manufactured, brand labeled or distributed by Belimo or Johnson Controls, Inc. or Siemens.
2. Size for torque required for damper seal at load conditions.
3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
4. Mounting: Actuators shall be direct shaft mount type. Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
5. Overload protected electronically throughout rotation.
6. Fail safe operation: Mechanical, spring return mechanism.
7. Power requirements (spring return): 24 VAC.
8. Proportional actuators shall be fully programmable through an EEPROM without the use of actuator mounted switches.
9. Temperature rating: -22 deg. F to +122 deg. F.
10. Housing: Minimum requirement NEMA Type 2/IP54 mounted in any orientation. NEMA 4/4X (IP67) required for outdoor applications.
11. Agency listings: ISO 9001 or UL.
12. The manufacturer shall warrant all components for a period of 5 years from the date of production with the first two years unconditional.
13. All damper actuators used on equipment introducing outdoor air shall be furnished with mechanical spring return mechanism as indicated in “fail safe operation” above.
14. All actuators shall have external adjustable stops to limit the travel in either direction and a gear release to allow manual positioning.
15. Actuators shall be provided with position feedback signal (2-10 VDC or 4-20 mA) where indicated on control drawings. Feedback signal shall be independent of the input signal and shall provide true position indication.

E. Dampers:

1. All automatic dampers furnished by this Contractor for modulating control shall be of the proportioning type with opposed or parallel blades depending on the application or as shown on the drawings. Dampers for two position action shall be of the opposed blade type for all applications except those located immediately at the inlet of fans and as noted otherwise on the drawings. Dampers for generator radiator fan exhaust shall be opposed blade type.
2. All dampers for outdoor air service and exhaust air service to be equivalent to TAMCO Series 9000 aluminum and have the following features:

    a. Frames shall be 4” deep X 1” and no less than .080” in thickness, mill finish extruded aluminum 6063-T5 with mounting flanges on both sides of the frame. Frame to be assembled using plated steel mounting fasteners.
    b. Entire frame shall be thermally broken by means of two polyurethane resin pockets complete with thermal cuts.
    c. Blades shall be extruded aluminum 6063-T5, mill finish air foil profiles, internally insulated with expanded polyurethane foam and shall be thermally broken.

d. Blade and frame seals shall be of extruded silicone and shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals are to be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip on type blade seals shall not be approved. Jamb seals shall be silicone.
e. Maintenance free bearings are to be composed of an inner bearing fixed to a 7/16" aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted into the frame. There shall be no metal-to-metal or metal-to-plastic contact.
f. Adjustable 7/16" hexagonal drive rod, U-bolt fastener and hexagonal retaining nuts shall be corrosion resistant, zinc plated steel to provide positive connection to blades and linkage.
g. Linkage hardware shall be installed in the frame side. All linkage crank arm and rod hardware parts shall be constructed of mill finished aluminum, complete with corrosion resistant, zinc plated trunnions and cup point trunnion screws for a slip-proof grip.
h. Dampers are to be designed for operation in temperatures ranging between -40 deg. F (-40 deg. C) and 212 deg. F (100 deg. C).
i. Dampers shall be rated Leakage Class 1A at 1 in. w.g. (0.25 kPa) static pressure differential. Standard air leakage data shall be certified under the AMCA Certified Ratings Program.
j. Dampers shall be made to size required without blanking off free area.
k. Dampers shall be available as "flanged to duct" mounting type.
l. Installation of dampers must be in accordance with manufacturer's installation guidelines provided with each damper shipment.
m. Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. (See manufacturer's installation guidelines).

3. Dampers for all other applications to be equal to TAMCO Series 1500 Ultra Low Leakage Air Foil Aluminum and have the following features:

a. Frames shall be 4" deep X 1" and no less than .080" in thickness, mill finish extruded aluminum 6063-T5 with mounting flanges on both sides of the frame. Frame to be assembled using plated steel mounting fasteners.
b. Entire frame shall be thermally broken by means of two polyurethane resin pockets complete with thermal cuts.
c. Blades shall be extruded aluminum 6063-T5, mill finish air foil profiles, internally insulated with expanded polyurethane foam and shall be thermally broken.
d. Blade and frame seals shall be of extruded silicone and shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals are to be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip on type blade seals shall not be approved.
e. Maintenance free bearings are to be composed of an inner bearing fixed to a 7/16" aluminum hexagon blade pivot pin, rotating within a polycarbonate

outer bearing inserted into the frame. There shall be no metal-to-metal or metal-to-plastic contact.

f. Adjustable 7/16” hexagonal drive rod, U-bolt fastener and hexagonal retaining nuts shall be corrosion resistant, zinc plated steel to provide positive connection to blades and linkage.
g. Linkage hardware shall be installed in the frame side. All linkage crank arm and rod hardware parts shall be constructed of mill finished aluminum, complete with corrosion resistant, zinc plated trunnions and cup point trunnion screws for a slip-proof grip.
h. Dampers are to be designed for operation in temperatures ranging between -40 deg. F (-40 deg. C) and 212 deg. F (100 deg. C).
i. Dampers shall be rated Leakage Class 1A at 1 in. w.g. (0.25 kPa) static pressure differential. Standard air leakage data shall be certified under the AMCA Certified Ratings Program.
j. Dampers shall be made to size required without blanking off free area.
k. Dampers shall be available with either opposed blade action or parallel blade action.
l. Dampers shall be available as “flanged to duct” mounting type.
m. Installation of dampers must be in accordance with manufacturer’s installation guidelines provided with each damper shipment.
n. Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. (See manufacturer’s installation guidelines).

4. Automatic dampers (modulating) shall be designed for face velocity that varies from 1,200 fpm to 2,000 fpm in most cases as approved by the design engineer. Dampers to be selected by the supplier with blade shaft lengths that prevent torsion that will create a leakage of more than 2 percent of the rated leakage capacity. Beyond that point, the dampers shall be broken into multiple sections. Field supplied mullions are required on large dampers exceeding 200 square feet.
5. Individual damper section actuators are preferred unless access to actuators is difficult and then jack shafting is acceptable. TCC to note that drive shafts between dampers of different air paths (i.e., outdoor air and return air or return air and exhaust air) is not acceptable. Jack shafting between sections is permitted when such shafting is designed to accommodate and eliminate the effects of torsion.
6. TCC to note that free access to all actuators is the responsibility of the TCC.
7. Each damper shall be equipped with an individual damper operator of the size and style required for the service intended.
8. Actuators to be designed for modulating control with spring return to the fail "safe" position. Actuators to be low voltage with 100% surplus torque (submittals to incorporate calculations to prove 100 percent closure under 4.0" wg status pressure differential for modulating service and 2.0" wg for two position application).
9. Terminal box/AFCV damper actuators to be low voltage, non-spring return and incremental control with 200 percent torque. All control actuators to utilize auto

zero program to insure total accuracy of damper actuator. The feature to be activated during periods of low or no occupancy.

F. Insertion Turbine Flow Meters for Closed Loop Condenser Water:

1. Provide dual turbine flow meter complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown. The flow meter shall be hand insertable up to 400 psi. The flow meter shall have two contra-rotating axial turbines, with electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
2. The flow meter shall be installed in accordance with the manufacturer's installation guide including meter orientation and straight pipe recommendations.
3. Wetted metal components shall be nickel-plated brass for applications operating below 250 degrees F, 316L SS construction for DW applications, HTHW applications operating over 250 degrees F, and for any application in non-metallic pipe. The maximum operating temperature shall be 280 degrees F, 300 F peak.
4. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter.
5. Accuracy shall be within ± 0.5% of rate at the calibrated velocity, within ± 1% of rate over a 10:1 turndown (3.0 to 30 ft/s) and within ± 2% of rate over a 50:1 turndown (from 0.4 to 20 ft/s).
6. The flow meter shall include integral analog output(s), 4-20 mA, 0-10V, or 0-5V, and a high resolution frequency output for use with peripheral devices (remote display or BTU Meter). FB-1210 for Bi-directional applications shall include an isolated contact closure output for direction.
7. The flow meter shall be covered by the manufacturer's three-year warranty.
8. Turbine meter shall be ONICON Incorporated Model F-1210 Dual Turbine, or equivalent as approved by the Engineer.

G. Energy BTU Measurement System:

1. The entire energy BTU measurement system shall be built and calibrated by a single manufacturer and shall consist of a flow meter, two temperature sensors, a BTU meter, temperature thermowells, and all required mechanical installation hardware. The BTU meter and associated sensors and flow meter shall be installed in accordance with the manufacturer's installation guide.
2. The BTU meter shall provide the following points both at the integral LCD and as outputs to the building control system: Energy total, Energy rate, flow rate, supply temperature and return temperature. Output signals shall be either serial network (protocol conforming to BACnet® MS/TP, JCI-N2, MODBUS RTU, MODBUS TCP, or Siemens-P1) and/or via individual analog and pulse outputs.
3. Each BTU meter shall be factory programmed and tagged for its specific application, and shall be re-programmable using the front panel keypad (no special interface device or computer required).

4. Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST traceable) for the specific temperature range for each application. The calculated differential temperature used in the energy calculation shall be accurate to within ±0.15˚F (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).
5. A certificate of NIST traceable calibration shall be provided with each system.
6. All equipment shall be covered by the manufacturer's three-year warranty.
7. Energy BTU measurement system shall be ONICON Incorporated System-10 BTU Meter, or equivalent as approved by the Engineer.

H. Differential Pressure Transmitter:

1. Liquid: Furnish field mounted differential pressure transmitters as indicated on plans for measuring differential pressure and transmitting an isolated 4 to 20 mA DC output linear differential pressure signal.

    a. Diaphragm type differential pressure transmitter: The unit shall be accurate RSS (non-linearity, hysteresis and non-repeatability) to ±0.25% of full scale. It shall withstand static pressures of 350 psig with negligible change in output. Furnish stainless steel wetted sensing components. A brass or stainless 3-valve bypass manifold and bracket mounting kit shall be utilized for easier on-site equalization and calibration.
        1) Transmitter shall be a standard institutional HVAC grade loop powered transmitter as manufactured by:
            a) Setra Model 230.
            b) Or approved equivalent.

2. Air: Furnish field mounted differential pressure transmitters using a 4-20 mA (or 0-10 VDC) output linear with measured differential pressure. Accuracy shall be ±0.8% of calibrated span. Response time shall be 250 milliseconds. Transmitter shall be in a standard grade transmitter manufactured by Ashcroft or Setra.

I. Airflow Measuring Stations:

1. All air flow measuring stations to be furnished under this contract as shown on control schematics and as scheduled.

    a. Approved manufacturers are Tek-Air Systems, Air Monitor, Paragon, Ebtron, Farr, and Airflow Wing.

2. Duct-mounted stations shall be installed by the Sheet Metal Contractor while fan inlet station installation responsibility shall be by this Contractor.
3. Sizing and physical location of stations shall be the responsibility of this Contractor. TCC to ensure that sufficient distance is available both upstream and downstream such that turbulence is not a factor in the velocity pressure measurement. Sizing shall insure that the minimum velocity across the station

affords accuracy of measurement and the design engineer shall be notified within 30 days of contract award if any modifications are required to the field ductwork.

4. TCC to ensure that a proper access door upstream of the station is provided in the ductwork such that the inlet face of the unit may be cleaned as necessary.

5. Fan inlet air flow sensing (non-intrusive piezometer type):

    a. Accuracy: Within 2% throughout the velocity range of 600 fpm and over, when installed in accordance with published recommendations
    b. Temperature: 350 deg F continuous operation; 400 deg F intermittent operation
    c. Humidity: 0-100% continuous operation
    d. Corrosion resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance
    e. Material: 6063-T5 anodized aluminum, galvanized mounting brackets

J. Thermal Dispersion Air Flow Measurement:

1. Air volume measurement system to consist of multiple sensors designed to average velocity using thermal dispersion principles. System to be designed to be totally independent of temperature, density, and humidity. Tek-Air or Ebtron.
2. The quantity of sensing tubes shall conform to manufacturer's requirements for spacing based on the specified accuracy and the actual inlet and outlet conditions.
3. Unit to be accurate to 1.5% between 50 fpm and 6000 fpm. Output to be 4-20 mA.

K. VAV/CAV Terminal Unit Control Components (DDC Control):

Component	Furnished By	Installed By	Wired By
Disconnect Switch	Manufacturer	Manufacturer	Manufacturer
Transformer	TCC	Manufacturer	Manufacturer
Damper Actuator	TCC	Manufacturer	Manufacturer
Flow Controller	TCC	Manufacturer	Manufacturer
Flow Sensing	Manufacturer	Manufacturer	Manufacturer
Misc Accessories	TCC	TCC	TCC

L. Control Valves:

1. Source Limitations: Obtain valves from single manufacturer.
2. Selection Criteria:

    a. Control valves shall be suitable for operation at following conditions:

        1) Refer to specification section 232113 – Hydronic Piping for system pressures.

b. In water systems, select modulating control valves for a design Cv based on a pressure drop of:

1) 1 psig for two-position unless otherwise indicated.
2) 5 psig for two way modulating unless otherwise indicated.
3) 5 psig for three way modulating unless otherwise indicated.

c. Actuators:

1) Actuators for Steam Control Valves: Shutoff against 1.5 times design pressure.

M. In-line Body Electromagnetic Flow Meter:

1. In-line electromagnetic flow meter shall be ONICON, model FT-3200 or approved equivalent by the Engineer.

2. Description:

a. No moving parts.
b. Suitable for flow measurement of fluids with electrical conductivity more than 5 micro-Seimens per cm.
c. Inherent bi-directional flow measurement.
d. Flow measurement with three pipe diameters upstream and two pipe diameters downstream.
e. Wet calibrate and tag meters to standards traceable to NIST, and provide each meter with a certificate of calibration.
f. Transmitter integral to meter.
g. Low voltage power: 24 Vac/Vdc power input.

3. Performance:

a. Accuracy for Velocities between 1.6 and 33 fps (1 and 10 m/s): Within 0.2 percent of reading.
b. Accuracy for Velocities Less than 1.0 fps (0.3 m/s): Within 0.0033 fps.
c. Ambient Temperature: Minus 4 to plus 140 deg F (Minus 20 to plus 60 deg C).
d. Process Temperature: Minus 4 to 212 deg F (Minus 20 to plus 100 deg C).
e. Pressure: 225 psig.

4. Analog Output Current Signal:

a. Two-wire, 4- to 20-mA dc current source.
b. Signal capable of operating into 1000-ohm load.
c. Isolated.

5. Digital Output Signal: Two, programmable, digital/pulse outputs configurable for frequency, pulse, or directional flow.
6. Operator Interface:

a. Keypad.
b. Digital Display: Multiple-line digital display of alphanumerical characters.
c. LED for normal and alarm operation.

7. Construction:

a. Body: Epoxy-coated carbon steel or Type 316 stainless steel.
b. Body Liner Material: PTFE.
c. Flow Tube: Type 304 stainless steel.
d. Connection: 150 Class flange or threaded.
e. Electrodes: Type 316 stainless steel. Quantity determined by manufacturer based on application.
f. Electronics Enclosure:

1) Painted aluminum.
2) Removable cover.
3) NEMA 250, Type 6.

g. Size to match line size of pipe.

8. Install per manufacturer's written instructions.

2.23 BALL-STYLE CONTROL VALVES

A. Ball Valves with Single Port and Characterized Disk:

1. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.
2. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
3. Close-off Pressure: 200 psig.
4. Process Temperature Range: Zero to 212 deg F.
5. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
6. End Connections: Threaded (NPT) ends.
7. Ball: 300 series stainless steel.
8. Stem and Stem Extension:

a. Material to match ball.
b. Blowout-proof design.
c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.

9. Ball Seats: Reinforced PTFE.

10. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
11. Flow Characteristic: Equal percentage.

B. Ball Valves with Two Ports and Characterized Disk:

1. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.
2. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
3. Close-off Pressure: 200 psig.
4. Process Temperature Range: Zero to 212 deg F.
5. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
6. End Connections: Threaded (NPT) ends.
7. Ball: 300 series stainless steel.
8. Stem and Stem Extension:

    a. Material to match ball.
    b. Blowout-proof design.
    c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.

9. Ball Seats: Reinforced PTFE.
10. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
11. Flow Characteristics for A-Port: Equal percentage.
12. Flow Characteristics for B-Port: Modified for constant common port flow.

2.24 GLOBE-STYLE CONTROL VALVES

A. General Globe-Style Valve Requirements:

1. Globe-style control valve body dimensions shall comply with ISA 75.08.01.
2. Construct the valves to be serviceable from the top.
3. For cage guided valves, trim shall be field interchangeable for different valve flow characteristics, such as equal percentage, linear, and quick opening.
4. Reduced trim for one nominal size smaller shall be available for industrial valves NPS 1 and larger.
5. Replaceable seats and plugs.
6. Furnish each control valve with a corrosion-resistant nameplate indicating the following:

    a. Manufacturer's name, model number, and serial number.

b. Body and trim size.
c. Arrow indicating direction of flow.

B. Two-Way Globe Valves NPS 2 and Smaller:

1. Globe Style: Single port.
2. Body: Cast bronze or forged brass with ASME B16.5, Class 250 rating.
3. End Connections: Threaded.
4. Bonnet: Screwed.
5. Packing: PTFE V-ring.
6. Plug: Top guided.
7. Plug, Seat, and Stem: stainless steel.
8. Process Temperature Range: 35 to 248 deg F.
9. Ambient Operating Temperature: 35 to 150 deg F.
10. Leakage: FCI 70-2, Class IV.
11. Rangeability: 25 to 1.
12. Equal percentage flow characteristic.

C. Three-Way Globe Valves NPS 2 and Smaller:

1. Globe Style: Mix flow pattern.
2. Body: Cast bronze or forged brass with ASME B16.5, Class 250 rating.
3. End Connections: Threaded.
4. Bonnet: Screwed.
5. Packing: PTFE V-ring.
6. Plug: Top guided.
7. Plug, Seat, and Stem: stainless steel.
8. Process Temperature Range: 35 to 248 deg F.
9. Ambient Operating Temperature: 35 to 150 deg F.
10. Leakage: FCI 70-2, Class IV.
11. Rangeability: 25 to 1.
12. Linear flow characteristic.

D. Two-Way Globe Valves NPS 2-1/2 to NPS 6:

1. Globe Style: Single port.
2. Body: Cast iron complying with ASME B61.1, Class 125.
3. End Connections: Flanged, suitable for mating to ASME B16.5, Class 150 flanges.
4. Bonnet: Bolted.
5. Packing: PTFE cone-ring.
6. Plug: Top or bottom guided.
7. Plug, Seat, and Stem: Brass or stainless steel.
8. Process Temperature Rating: 35 to 281 deg F.
9. Leakage: 0.1 percent of maximum flow.
10. Rangeability: Varies with valve size between 6 and 10 to 1.
11. Modified linear flow characteristic.

2.25 ACCESSORIES

A. Damper Blade Limit Switches:

1. Sense positive open and/or closed position of the damper blades.
2. NEMA 250, Type 13, oil-tight construction.
3. Arrange for the mounting application.
4. Additional waterproof enclosure when required by its environment.
5. Arrange to prevent "over-center" operation.

2.26 IDENTIFICATION

A. Instrument Air Pipe and Tubing:

1. Engraved tag shall bear the following information:

a. Service (Example): "Instrument Air."
b. Pressure Range (Example): 0 to 30 psig.

2. Letter size shall be a minimum of 0.25 inch ~~**<Insert dimension>**~~ high.
3. Tag shall consist of white lettering on blue background.
4. Tag shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded blue with contrasting white center exposed by engraving through outer layer.
5. Include tag with a brass grommet, chain and S-hook.

B. Control Equipment, Instruments, and Control Devices:

1. Engraved tag bearing unique identification.

a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Letter size shall be as follows:

~~**a. Operator Workstations: Minimum of [0.5 inch] <Insert dimension> high.**~~
~~**b. Printers: Minimum of [0.5 inch] <Insert dimension> high.**~~
c. DDC Controllers: Minimum of **0.5 inch** ~~**<Insert dimension>**~~ high.
d. Gateways: Minimum of **0.5 inch** ~~**<Insert dimension>**~~ high.
e. Repeaters: Minimum of **0.5 inch** ~~**<Insert dimension>**~~ high.
f. Enclosures: Minimum of **0.5 inch** ~~**<Insert dimension>**~~ high.
g. Electrical Power Devices: Minimum of **0.25 inch** ~~**<Insert dimension>**~~ high.
h. UPS units: Minimum of **0.5 inch** ~~**<Insert dimension>**~~ high.
i. Accessories: Minimum of **0.25 inch** ~~**<Insert dimension>**~~ high.
j. Instruments: Minimum of **0.25 inch** ~~**<Insert dimension>**~~ high.

k. Control Damper and Valve Actuators: Minimum of **0.25 inch** ~~**<Insert dimension>**~~ high.

3. Tag shall consist of white lettering on black background.
4. Tag shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer.
5. Tag shall be fastened with drive pins.
6. Instruments, control devices and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Valve Tags:

1. Brass tags and brass chains attached to valve.
2. Tags shall be at least **1.5 inches** ~~**<Insert dimension>**~~ in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

D. Raceway and Boxes:

1. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Paint cover plates on junction boxes and conduit same color as the tape banding for conduits. After painting, label cover plate "HVAC Controls," using an engraved phenolic tag.
3. For raceways housing pneumatic tubing, add a phenolic tag labeled "HVAC Instrument Air Tubing."
4. For raceways housing air signal tubing, add a phenolic tag labeled "HVAC Air Signal Tubing."

E. Equipment Warning Labels:

1. Acrylic label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size shall be at least 14-point type with white lettering on red background.
3. Warning label shall read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering shall be enclosed in a white line border. Edge of label shall extend at least 0.025 inch beyond white border.

2.27 SOURCE QUALITY CONTROL

A. Product(s) and material(s) will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for products to verify actual locations of connections before installation.

1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 DDC SYSTEM INTERFACE WITH OTHER SYSTEMS AND EQUIPMENT

A. Communication Interface to Equipment with Integral Controls:

1. DDC system shall have communication interface with equipment having integral controls and having a communication interface for remote monitoring or control.
2. Equipment to Be Connected:
   a. Air-terminal units specified in Section 233600 "Air Terminal Units."
   b. Boilers specified in Section 235216 "Condensing Boilers."
   c. Chillers specified in Section 236423.21 "Air-Cooled, Scroll Water Chillers."
   d. Air-handling units specified in Section 237313 "Custom Air-Handling Units."
   e. Humidifiers specified in Section 238413 "Humidifiers."
   f. Switchboards specified in Section 262300 "Low-Voltage Switchgear."

g. Variable-frequency controllers specified in Section 262923 "Variable-Frequency Motor Controllers."
h. Refrigerant monitoring.

3.3 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. DDC control dampers, which are specified in Section 230923.
2. Airflow sensors and switches, which are specified in Section 230923.
3. Pressure sensors, which are specified in Section 230923.

C. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. DDC control valves, which are specified in Section 230923.
2. Pipe-mounted flow meters, which are specified in Section 230923.
3. Pipe-mounted sensors, switches and transmitters. Flow meters are specified in Section 230923. Liquid temperature sensors, switches, and transmitters are specified in Section 230923.
4. Tank-mounted sensors, switches and transmitters. Pressure sensors, switches, and transmitters are specified in Section 230923. Liquid temperature sensors, switches, and transmitters are specified in Section 230923.
5. Pipe- and tank-mounted thermowells. Liquid thermowells are specified in Section 230923.

3.4 CONTROL DEVICES FOR EQUIPMENT MANUFACTURER FACTORY INSTALLATION

A. Deliver the following to air-handling unit manufacturer for factory installation. Include installation instructions to air-handling unit manufacturer
1. Unit-mounted DDC control dampers and actuators, which are specified in Section 230923.
2. Unit-mounted airflow sensors, switches and transmitters, which are specified in Section 230923.
3. Unit-mounted speed sensors, switches and transmitters, which are specified in Section 230923.

4. Unit-mounted pressure sensors, switches and transmitters, which are specified in Section 230923.
5. Unit-mounted temperature sensors, switches and transmitters. Air-temperature sensors, switches, and transmitters are specified in Section 230923.
6. Relays.

B. Deliver the following to terminal unit manufacturer for factory installation. Include installation instructions to terminal unit manufacturer.

1. Programmable application or application-specific controller.
2. Electric damper actuator. Dampers actuators are specified in Section 230923.
3. Unit-mounted flow and pressure sensors, transmitters and transducers. Flow sensors, transmitters, and transducers are specified in Section 230923. Pressure sensors, switches, and transmitters are specified in Section 230923.
4. Unit-mounted temperature sensors. Air-temperature sensors, switches, and transmitters are specified in Section 230923.
5. Relays.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to a ~~**<Insert value>**~~ force.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Firestop penetrations made in fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. Welding Requirements:

1. Restrict welding and burning to supports and bracing.
2. No equipment shall be cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.

3. Welding, where approved, shall be by inert-gas electric arc process and shall be performed by qualified welders according to applicable welding codes.
4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.

I. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.

J. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

K. Corrosive Environments:

1. Avoid or limit use of materials in corrosive airstreams and environments, including, but not limited to, the following:

   a. Laboratory exhaust-air streams.
   b. Process exhaust-air streams.

2. When conduit is in contact with a corrosive airstream and environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment. Comply with requirements for installation of raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
3. Where instruments are located in a corrosive airstream and are not corrosive resistant from manufacturer, field install products in NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.6 OPERATOR WORKSTATION INSTALLATION

A. Desktop Operator Workstations Installation:

~~1. Install operator workstation(s) at location(s) directed by Owner.~~
~~2. Install multiple-receptacle power strip with cord for use in connecting multiple workstation components to a single duplex electrical power receptacle.~~
~~3. Install software on workstation(s) and verify software functions properly.~~
4. Develop Project-specific graphics, trends, reports, logs and historical database.
~~5. Power workstation through a dedicated UPS unit. Locate UPS adjacent to workstation.~~

B. Portable Operator Workstations Installation:

1. Turn over portable operator workstations to Owner at Substantial Completion.
2. Install software on workstation(s) and verify software functions properly.

C. Color Graphics Application:

1. Use system schematics indicated as starting point to create graphics.
2. Develop Project-specific library of symbols for representing system equipment and products.
3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
4. Submit sketch of graphic layout with description of all text for each graphic for Owner's and Engineer’s review before creating graphic using graphics software.
5. Seek Owner input in graphics development once using graphics software.
6. Final editing shall be done on-site with Owner's and Engineer’s review and feedback.
7. Refine graphics as necessary for Owner acceptance.
8. On receiving Owner acceptance, print a hard copy for inclusion in operation and maintenance manual. Prepare a scanned copy PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.

3.7 GATEWAY INSTALLATION

A. Install gateways if required for DDC system communication interface requirements indicated.

1. Install gateway(s) required to suit indicated requirements.

B. Test gateway to verify that communication interface functions properly.

3.8 ROUTER INSTALLATION

A. Install routers if required for DDC system communication interface requirements indicated.

1. Install router(s) required to suit indicated requirements.

B. Test router to verify that communication interface functions properly.

3.9 CONTROLLER INSTALLATION

A. Install controllers in enclosures to comply with indicated requirements.

B. Connect controllers to field power supply and to UPS units where indicated.

C. Install controller with latest version of applicable software and configure to execute requirements indicated.

D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.

E. Installation of Network Controllers:

1. Quantity and location of network controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Top of controller shall be within 72 inches of finished floor.

F. Installation of Programmable Application Controllers:

1. Quantity and location of programmable application controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Top of controller shall be within **72 inches** [~~**84 inches**~~] ~~**<Insert dimension>**~~ of finished floor.

G. Application-Specific Controllers:

1. Quantity and location of application-specific controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in a protected location that is easily accessible by operators.

3.10 ENCLOSURES INSTALLATION

A. Install the following items in enclosures, to comply with indicated requirements:

1. Gateways.
2. Routers.
3. Controllers.
4. Electrical power devices.
5. UPS units.
6. Relays.
7. Accessories.
8. Instruments.
9. Actuators

B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use painted steel or corrosion-resistant-coated steel strut and hardware.
2. Install plastic caps on exposed cut edges of strut.

C. Align top of adjacent enclosures of like size.

D. Install floor-mounted enclosures located in mechanical equipment rooms on concrete housekeeping pads. Attach enclosure legs using stainless-steel anchors.

E. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireway used for application shall have protection equal to NEMA 250 rating of connected enclosures.

3.11 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade. Work shall comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.12 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install engraved phenolic nameplate with unique identification on face for each of the following:

~~**1. Operator workstation.**~~
~~**2. Printer.**~~
3. Gateway.
4. Router.
5. DDC controller.
6. Enclosure.
7. Electrical power device.
8. UPS unit.
9. Accessory.

C. Install engraved phenolic nameplate with unique instrument identification on face of each instrument connected to a DDC controller.

D. Install engraved phenolic nameplate with identification on face of each control **damper and valve** actuator connected to a DDC controller.

E. Where product is installed above accessible tile ceiling, also install matching engraved phenolic nameplate with identification on face of ceiling grid located directly below.

F. Where product is installed above an inaccessible ceiling, also install engraved phenolic nameplate with identification on face of access door directly below.

G. Warning Labels:

1. Shall be permanently attached to equipment that can be automatically started by DDC control system.
2. Shall be located in highly visible location near power service entry points.

3.13 NETWORK INSTALLATION

A. Install copper cable when connecting between the following network devices located in same building:

~~**1. Operator workstations.**~~
2. Operator workstations and network controllers.
3. Network controllers.

B. Install copper cable when connecting between the following:

1. Gateways.
2. Gateways and network controllers or programmable application controllers.
3. Routers.
4. Routers and network controllers or programmable application controllers.
5. Network controllers and programmable application controllers.
6. Programmable application controllers.
7. Programmable application controllers and application-specific controllers.
8. Application-specific controllers.
~~9. **<Insert network device>**.~~

C. Install network cable in continuous raceway.

1. Where indicated on Drawings, cable trays may be used for copper cable in lieu of conduit.

3.14 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

B. ASHRAE 135 Networks:

1. MAC Address:

a. Every network device shall have an assigned and documented MAC address unique to its network.
b. Ethernet Networks: Document MAC address assigned at its creation.
c. ARCNET or MS/TP networks: Assign from 00 to 64.

2. Network Numbering:

a. Assign unique numbers to each new network.
b. Provide ability for changing network number through device switches or operator interface.
c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.

3. Device Object Identifier Property Number:

a. Assign unique device object identifier property numbers or device instances for each device network.
b. Provide for future modification of device instance number by device switches or operator interface.
c. LAN shall support up to 4,194,302 unique devices.

4. Device Object Name Property Text:

a. Device object name property field shall support 32 minimum printable characters.
b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.

1) Example 1: Device object name for device controlling boiler plant at Building 1000 would be "HW System B1000."
2) Example 2: Device object name for a VAV terminal unit controller could be "VAV unit 102".

5. Object Name Property Text for Other Than Device Objects:

a. Object name property field shall support 32 minimum printable characters.
b. Assign object name properties with plain-English names descriptive of application.

1) Example 1: "Zone 1 Temperature."
2) Example 2 "Fan Start and Stop."

6. Object Identifier Property Number for Other Than Device Objects:

a. Assign object identifier property numbers according to Drawings indicated.
b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented and be unique for like object types within device.

3.15 PIPING AND TUBING INSTALLATION

A. Above-Grade Pneumatic and Air Signal Piping and Tubing Installation:

1. Material Application:

a. Install copper tubing, except as follows:

1) Tubing Exposed to View: Polyethylene tubing installed in raceways may be used in lieu of copper tubing.
2) Concealed Tubing: Polyethylene tubing may be used in lieu of copper tubing when concealed behind accessible ceilings and concealed in walls and connecting wall-mounted instruments with recessed connections.

b. Install copper tubing, unless other accessible materials are indicated, for air signals to instruments including, but not limited to, the following:

1) Sensors.
2) Switches.
3) Transmitters.

c. Install drawn-temper copper tubing, except within 36 inches of device terminations tubing shall be annealed-tempered copper tubing.
d. Install compression fittings to connect copper tubing to instruments, control devices, and accessories.
e. Install compression fittings to connect polyethylene tubing to instruments, control devices, and accessories.

2. Routing:

a. Do not expose tubing in finished spaces, such as spaces with ceilings; occupied spaces, offices, and conference rooms, unless expressly approved in writing by Architect. Tubing may be exposed in areas without ceilings.

b. Where tubing is installed in finished occupied spaces, install the tubing in surface metal raceway with appropriate fittings only where not feasible to conceal in wall, above ceiling or behind architectural enclosures or covers.
c. Install piping and tubing plumb and parallel to and at right angles with building construction.
d. Install multiple runs of tubing or piping in equally spaced parallel lines.
e. Piping and tubing shall not interfere with access to valves, equipment, duct and equipment access doors, or obstruct personnel access and passageways of any kind.
f. Coordinate with other trades before installation to prevent proposed piping and tubing from interfering with pipe, duct, terminal equipment, light fixtures, conduit and cable tray space. If changes to Shop Drawings are necessary due to field coordination, document changes on record Drawings.
g. Install vibration loops in copper tubing when connecting to instrument and actuators that vibrate.

3. Support:

a. According to MSS SP-69, Table 3, except support spacing shall not exceed 60 inches.
b. Support copper tubing with copper hangers, clips, and tube trays.
c. Do not use tape for support or dielectric isolation.
d. Install supports at each change in direction and at each branch take off.
e. Attached supports to building structure independent of work of other trades. Support from ducts, pipes, cable trays, and conduits is prohibited.
f. Attached support from building structure with threaded rods, structural shapes, or channel strut.
g. Install and brace supports to carry static load plus a safety margin, which will allow tubing to be serviced.
h. Brace supports to prevent lateral movement.
i. Paint steel support members that are not galvanized or zinc coated.
j. Support polyethylene tubing same as copper tubing.

4. Do not attach piping and tubing to equipment that may be removed frequently for maintenance or that may impart vibration and expansion from temperature change.
5. Protect exposed tubing in mechanical equipment rooms from mechanical damage within 96 inches above floor. Use aluminum channel reversed and secured over tubing to protect tubing from damage.
6. Joining and Makeup:

a. Where joining and mating dissimilar metals where galvanic action could occur, install dielectric isolation.
b. Install a dirt leg with an isolation valve and threaded plug at each main air, connection to a panel, pneumatic pilot positioner and PRV station.

c. Make threaded joints for connecting to instrument equipment with connectors with a compression tubing connector on one end and threaded connection on other end.
d. Make tubing bends with a tube-bending tool. Hard bends, wrinkled or flattened bends are unacceptable.
e. Install tube fittings according to manufacturer's written instructions.
f. Do not make tubing connections to a fitting before completing makeup of the connection.
g. Align tubing with the fitting. Avoid springing tube into position, as this may result in excessive stress on both tubing and fitting with possible resulting leaks.
h. Do not install fittings close to a bend. A length of straight tubing, not deformed by bending, is required for a proper connection.
i. Check tubing for correct diameter and wall thickness.
j. Tube ends shall be cut square and deburred. Exercise care during cutting to keep tubing round.
k. Thread pipe on a threading machine. Ream inner edges of pipe ends, file and grind to remove burrs.
l. Wrap pipe threads of fittings on pneumatic lines with a single wrap of PTFE tape.
m. Protect piping and tubing from entrance of foreign matter.

7. Conduit in which nonmetallic tubing is installed shall not exceed 50 percent fill. Support conduit according to NFPA 70 unless otherwise indicated.

B. Identify piping and tubing as follows:

1. Every 50 feet of straight run.
2. At least once for each branch within 36 inches of main tee.
3. At each change in direction.
4. Within 36 inches of each ceiling, floor, roof and wall penetration.
5. Where exposed to and where concealed from view, including above ceiling plenums, shafts, and chases.
6. At each valve.
7. Mark each instrument tube connection with a number-coded identification. Each unique tube shall have same unique number at instrument connection and termination at opposite end of tube.

C. Isolation Valves Installation:

1. Install valves full size of piping and tubing.
2. Install at the following locations:

a. At each branch.
b. Before and after each PRV.
c. Before and after each air dryer.
d. At each control device.

3. Valves shall be located to be readily accessible from floor.

D. Process Tubing Installation:

1. Install process tubing for signal to instruments in liquid and steam systems. Instruments include, but are not limited to, the following:

    a. Meters.
    b. Sensors.
    c. Switches.
    d. Transmitters.

2. Support tubing according to MSS SP-69, Table 3, but at intervals no less than 60 inches.
3. Install NPS 1/2 process tubing for industrial-grade sensors, transmitters, and switches. Install stainless-steel bushings where required.
4. Make tubing bends with a bending tool. Flattened or wrinkled bends are unacceptable.
5. Support tubing independent of other trades.
6. Route tubing parallel to and at right angles to building construction.
7. Install tubing concealed in areas with ceilings.
8. Install a dirt leg with an isolation valve and threaded plug in drain valve at each connection to a transmitter and switch.
9. Insulate process piping connected to hot water and steam systems for personnel protection if the surface temperature exceeds 120 deg F. Only insulate piping within maintenance personnel reach from floor, platform, or catwalk.
10. Wrap pipe threads of fitting in process tubing with service temperatures below 350 deg F with a single wrap of PTFE tape.
11. Coat pipe threads of fittings on process tubing in services with temperatures exceeding 350 deg F with pipe compound before being made up to reduce the possibility of galling.
12. Do not make tubing connections to a fitting before completing makeup of the connection.
13. Check tubing for correct diameter and wall thickness. Cut the tube ends square and deburred. Exercise care during cutting to keep tubing round.
14. Do not install fittings close to a bend. A length of straight tubing, not deformed by bending, is required for a proper connection.
15. Align tubing with fitting when installed. Avoid springing tube into position.
16. Install tubing with extreme care exercised to keep foreign matter out of system. Open tubing ends shall be kept plugged to keep out dust, dirt and moisture.
17. Do not attach tubing to equipment that may be removed frequently for maintenance or may impart vibration and expansion from temperature change.
18. Protect exposed tubing in mechanical equipment rooms from inadvertent mechanical damage within 96 inches above floor. Use aluminum channel reversed and secured over tubing to protect tubing from damage.

E. Isolation Valves Installation:

1. Install valves full size of piping and tubing.
2. Install isolation valves at the following locations:

    a. Process connection.
    b. Inlet to each instrument including, sensors, transmitters, switches, gages, and other control devices.

3. Locate valves to be readily accessible from floor.

3.16 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

A. Comply with NECA 1.

B. Comply with TIA 568-C.1.

C. Wiring Method: Install cables in raceways and cable trays except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. Field Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

F. Conduit Installation:

1. Install conduit expansion joints where conduit runs exceed 200 feet, and conduit crosses building expansion joints.
2. Coordinate conduit routing with other trades to avoid conflicts with ducts, pipes and equipment and service clearance.
3. Maintain at least 3-inch separation where conduits run axially above or below ducts and pipes.
4. Limit above-grade conduit runs to 100 feet without pull or junction box.
5. Do not install raceways or electrical items on any "explosion-relief" walls, or rotating equipment.
6. Do not fasten conduits onto the bottom side of a metal deck roof.
7. Flexible conduit is permitted only where flexibility and vibration control is required.
8. Limit flexible conduit to 3 feet long.

9. Conduit shall be continuous from outlet to outlet, from outlet to enclosures, pull and junction boxes, and shall be secured to boxes in such manner that each system shall be electrically continuous throughout.
10. Direct bury conduits underground or install in concrete-encased duct bank where indicated.

    a. Use rigid, nonmetallic, Schedule 80 PVC.
    b. Provide a burial depth according to NFPA 70, but not less than 24 inches.

11. Secure threaded conduit entering an instrument enclosure, cabinet, box, and trough, with a locknut on outside and inside, such that conduit system is electrically continuous throughout. Provide a metal bushing on inside with insulated throats. Locknuts shall be the type designed to bite into the metal or, on inside of enclosure, shall have a grounding wedge lug under locknut.
12. Conduit box-type connectors for conduit entering enclosures shall have an insulated throat.
13. Connect conduit entering enclosures in wet locations with box-type connectors or with watertight sealing locknuts or other fittings.
14. Offset conduits where entering surface-mounted equipment.
15. Seal conduit runs used by sealing fittings to prevent the circulation of air for the following:

    a. Conduit extending from interior to exterior of building.
    b. Conduit extending into pressurized duct and equipment.
    c. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.

G. Wire and Cable Installation:

1. Cables serving a common system may be grouped in a common raceway. Install control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
2. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.

    a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.

3. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
5. UTP Cable Installation:

a. Comply with TIA 568-C.2.
b. Do not untwist UTP cables more than 1/2 inch from the point of termination, to maintain cable geometry.

6. Installation of Cable Routed Exposed under Raised Floors:

   a. Install plenum-rated cable only.
   b. Install cabling after the flooring system has been installed in raised floor areas.
   c. Coil cable **6 feet ~~<Insert dimension>~~** long not less than **12 inches ~~<Insert dimension>~~** in diameter below each feed point.

7. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.
8. Provide strain relief.
9. Terminate wiring in a junction box.

   a. Clamp cable over jacket in junction box.
   b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.

10. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
11. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
12. Keep runs short. Allow extra length for connecting to terminal boards. Do not bend flexible coaxial cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
13. Ground wire shall be copper and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.
14. Wire and cable shall be continuous from terminal to terminal without splices.
15. Use insulated spade lugs for wire and cable connection to screw terminals.
16. Use shielded cable to transmitters.
17. Use shielded cable to temperature sensors.
18. Perform continuity and meager testing on wire and cable after installation.
19. Do not install bruised, kinked, scored, deformed, or abraded wire and cable. Remove and discard wire and cable if damaged during installation, and replace it with new cable.
20. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
21. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
22. Protection from Electro-Magnetic Interference (EMI): Provide installation free of (EMI). As a minimum, comply with the following requirements:

a. Comply with BICSI TDMM and TIA 569-C for separating unshielded cable from potential EMI sources, including electrical power lines and equipment.
b. Separation between open cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

c. Separation between cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

d. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

e. Separation between Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
f. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Testing of Pneumatic and Air-Signal Tubing:

    a. Test for leaks and obstructions.
    b. Disconnect each pipe and tubing line before a test is performed, and blowout dust, dirt, trash, condensate and other foreign materials with compressed air. Use commercially pure compressed air or nitrogen as distributed in gas cylinders. Air from an oil-free compressor with an air dryer is an acceptable alternative for the test.
    c. After foreign matter is expelled and line is free from obstructions, plug far end of tubing run.
    d. Connect a pressure source to near end of run with a needle valve between air supply and tubing run.
    e. Connect a pressure gage accurate to within 0.5 percent of test between the shutoff needle valve and tubing run under test.
    f. For system pressures above 30 psig, apply a pressure of 1.5 times operating pressure. Record pressure in tubing run every 10 minutes for one hour. Allowable drop in pressure in one-hour period shall not exceed 1 psig.
    g. For system pressures 30 psig and below, apply a pressure of 2.0 times operating pressure to piping and tubing run. Record pressure in tubing run every 5 minutes for one hour. Allowable drop in pressure in one-hour period shall not exceed 0.5 psig.

D. Testing:

1. Perform preinstallation, in-progress, and final tests, supplemented by additional tests, as necessary.
2. Preinstallation Cable Verification: Verify integrity and serviceability for new cable lengths before installation. This assurance may be provided by using vendor verification documents, testing, or other methods. As a minimum, furnish evidence of verification for cable attenuation and bandwidth parameters.
3. In-Progress Testing: Perform standard tests for correct pair identification and termination during installation to ensure proper installation and cable placement. Perform tests in addition to those specified if there is any reason to question condition of material furnished and installed. Testing accomplished is to be documented by agency conducting tests. Submit test results for Project record.
4. Final Testing: Perform final test of installed system to demonstrate acceptability as installed. Testing shall be performed according to a test plan supplied by DDC system manufacturer. Defective Work or material shall be corrected and retested. As a minimum, final testing for cable system, including spare cable, shall verify conformance of attenuation, length, and bandwidth parameters with performance indicated.

5. Test Equipment: Use a fiber-optic time domain reflectometer for testing of length and optical connectivity.
6. Test Results: Record test results and submit copy of test results for Project record.

3.18 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material and support.

E. For pneumatic products, verify that air supply for each product is properly installed.

F. Control Damper Checkout:

1. Verify that control dampers are installed correctly for flow direction.
2. Verify that proper blade alignment, either parallel or opposed, has been provided.
3. Verify that damper frame attachment is properly secured and sealed.
4. Verify that damper actuator and linkage attachment is secure.
5. Verify that actuator wiring is complete, enclosed and connected to correct power source.
6. Verify that damper blade travel is unobstructed.

G. Control Valve Checkout:

1. For pneumatic valves, verify that pressure gages are provided in each air line to valve actuator and positioner.
2. Verify that control valves are installed correctly for flow direction.
3. Verify that valve body attachment is properly secured and sealed.
4. Verify that valve actuator and linkage attachment is secure.
5. Verify that actuator wiring is complete, enclosed and connected to correct power source.
6. Verify that valve ball, disc or plug travel is unobstructed.
7. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

H. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.

2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments:

    a. Verify sensing element type and proper material.
    b. Verify length and insertion.

3.19 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.

I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

J. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

K. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

L. Control Dampers:

1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open at proper air pressure.
3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

M. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed and 100 percent open at proper air pressures.
3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

N. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

O. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

P. Switches: Calibrate switches to make or break contact at set points indicated.

Q. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.

2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.20 DDC SYSTEM CONTROLLER CHECKOUT

A. Verify power supply.

1. Verify voltage, phase and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to a backup power source.
6. If applicable, verify that power conditioning units, transient voltage suppression and high-frequency noise filter units are installed.

B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.21 DDC CONTROLLER I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify operation is stable and accurate.
4. Adjust control loop proportional, integral and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:

    a. Upper quarter of range.
    b. Lower quarter of range.
    c. At midpoint of range.

8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller and at field instrument shall match.

10. Prepare and submit a report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.22 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed test checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Using BACnet protocol analyzer, verify that communications are error free.
10. Each controller's programming is backed up.
11. Equipment, products, tubing, wiring cable and conduits are properly labeled.
12. All I/O points are programmed into controllers.
13. Testing, adjusting and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power.
18. Meter, sensor and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
26. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit a validation test plan including test procedures for performance validation tests.
2. Test plan shall address all specified functions of DDC system and sequences of operation.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include a test checklist to be used to check and initial that each test has been successfully completed.
6. Submit test plan documentation **10** ~~[**20**] **<Insert number>**~~ business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.

    a. Verify analog I/O points at operating value.
    b. Make adjustments to out-of-tolerance I/O points.

        1) Identify I/O points for future reference.
        2) Simulate abnormal conditions to demonstrate proper function of safety devices.
        3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.

2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. After 24 Hours following Initial Validation Test:

    a. Re-check I/O points that required corrections during initial test.
    b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. After 24 Hours of Second Validation Test:

    a. Re-check I/O points that required corrections during second test.
    b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

G. DDC System Response Time Test:

1. Simulate HLC.

   a. Heavy load shall be an occurrence of 50 percent of total connected binary COV, one-half of which represent an "alarm" condition, and 50 percent of total connected analog COV, one-half of which represent an "alarm" condition, that are initiated simultaneously on a one-time basis.

2. Initiate 10 successive occurrences of HLC and measure response time to typical alarms and status changes.
3. Measure with a timer having at least 0.1-second resolution and 0.01 percent accuracy.
4. Purpose of test is to demonstrate DDC system, as follows:

   a. Reaction to COV and alarm conditions during HLC.
   b. Ability to update DDC system database during HLC.

5. Passing test is contingent on the following:

   a. Alarm reporting at printer beginning no more than two seconds after the initiation (time zero) of HLC.
   b. All alarms, both binary and analog, are reported and printed; none are lost.
   c. Compliance with response times specified.

6. Prepare and submit a report documenting HLC tested and results of test including time stamp and print out of all alarms.

H. DDC System Network Bandwidth Test:

1. Test network bandwidth usage on all DDC system networks to demonstrate bandwidth usage under DDC system normal operating conditions and under simulated HLC.
2. To pass, none of DDC system networks shall use more than 70 percent of available bandwidth under normal and HLC operation.

3.23 FINAL REVIEW

A. Submit written request to Engineer and Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.

3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Engineer and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:

    a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
    b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to ~~[10]~~ **20** ~~**<Insert number>**~~ I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
    c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
    d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
    e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
    f. Trends, summaries, logs and reports set-up for Project.

g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
i. Software's ability to edit control programs off-line.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Programmable Application Controller:

1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
2) Operator Interface: Ability to connect directly to each type of digital controller with a portable operator workstation and PDA. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
4) Electric Power: Ability to disconnect any controller safely from its power source.
5) Wiring Labels: Match control drawings.
6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators and devices.

r. For Each Operator Workstation:

1) I/O points lists agree with naming conventions.
2) Graphics are complete.
3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to

help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:

    a) Display of network device status.
    b) Display of BACnet Object Information.
    c) Silencing devices transmitting erroneous data.
    d) Time synchronization.
    e) Remote device re-initialization.
    f) Backup and restore network device programming and master database(s).
    g) Configuration management of routers.

~~t. **<Insert additional requirements>**.~~

3.24 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

3.25 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 months' full maintenance by DDC system manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.26 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support & upgrades for two year(s).

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two year(s) from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

3.27 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:

a. Provide not less than 5 days of training total.
b. Stagger training over multiple training classes to accommodate Owner's requirements. All training shall occur before end of warranty period.
c. Total days of training shall be broken into separate training classes.

C. Training Schedule:

1. Schedule training with Owner 10 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 20 business days of notice in advance of training.
3. Training shall occur within normal business hours at a mutually agreed on time. Unless otherwise agreed to, training shall occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session shall be split in half with 15-minute break between sessions. Morning and afternoon sessions shall be separated by 60-minute lunch period. Training, including breaks and excluding lunch period, shall not exceed 6 hours per day.
4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Preprinted sign-in sheet shall include training session number, date and time, instructor name, phone number and e-mail address, and brief description of content to be covered during session. List attendees with columns for name, phone number, e-mail address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Training Attendee Headcount:

1. Plan in advance of training for two attendees.
2. Make allowance for Owner to add up to one attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Training Attendee Prior Knowledge: For guidance in planning required training and instruction, assume attendees have the following:

1. Advanced knowledge of HVAC systems, DDC systems, and products installed.

G. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

H. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

    a. Daily operators.
    b. Advanced operators.
    c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions that cover restricted content for purposes of maintaining DDC system security.

I. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

J. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.
2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.

5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

K. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables desks or tables, chairs, power and data connectivity for each attendee.
2. Provide capability to remotely access to Project DDC system for use in training.
3. Provide a workstation for use by each attendee.

L. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.
5. Operating operator workstations, printers and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.
14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Running each specified report and log.
16. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
17. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
18. Executing digital and analog commands in graphic mode.
19. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.
20. Demonstrating DDC system performance through trend logs and command tracing.
21. Demonstrating scan, update, and alarm responsiveness.
22. Demonstrating spreadsheet and curve plot software, and its integration with database.

23. Demonstrating on-line user guide, and help function and mail facility.
24. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
25. Demonstrating the following for HVAC systems and equipment controlled by DDC system:

    a. Operation of HVAC equipment in normal-off, -on and failed conditions while observing individual equipment, dampers and valves for correct position under each condition.
    b. For HVAC equipment with factory-installed software, show that integration into DDC system is able to communicate with DDC controllers or gateways, as applicable.
    c. Using graphed trends, show that sequence of operation is executed in correct manner, and HVAC systems operate properly through complete sequence of operation including seasonal change, occupied and unoccupied modes, warm-up and cool-down cycles and other modes of operation indicated.
    d. Hardware interlocks and safeties function properly and DDC system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
    e. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
    f. Each control loop responds to set point adjustment and stabilizes within time period indicated.
    g. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.

M. Training Content for Advanced Operators:

1. Making and changing workstation graphics.
2. Creating, deleting and modifying alarms including annunciation and routing.
3. Creating, deleting and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
4. Creating, deleting and modifying reports.
5. Creating, deleting and modifying points.
6. Creating, deleting and modifying programming including ability to edit control programs off-line.
7. Creating, deleting and modifying system graphics and other types of displays.
8. Adding DDC controllers and other network communication devices such as gateways and routers.
9. Adding operator workstations.
10. Performing DDC system checkout and diagnostic procedures.
11. Performing DDC controllers operation and maintenance procedures.
12. Performing operator workstation operation and maintenance procedures.
13. Configuring DDC system hardware including controllers, workstations, communication devices and I/O points.
14. Maintaining, calibrating, troubleshooting, diagnosing and repairing hardware.

15. Adjusting, calibrating and replacing DDC system components.

N. Training Content for System Managers and Administrators:

1. DDC system software maintenance and backups.
2. Uploading, downloading and off-line archiving of all DDC system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.
7. Operator authority assignment and modification.
8. Workstation data segregation and modification.

O. Video of Training Sessions:

1. Provide a digital video and audio recording of each training session. Create a separate recording file for each session.
2. Stamp each recording file with training session number, session name and date.
3. Provide Owner with two copies of digital files on flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

END OF SECTION 230923

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SECTION 232113.13 - UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This section defines the minimum quality, design criteria, tools and equipment, methods and procedures, materials and components for furnishing, fabricating, assembling, installing and testing permanently installed Piping Systems for the utility drawings as shown on the drawings, flow diagrams, data sheets, lists and schedules or specified in notes and other instructions and made a part of these technical section.

C. All piping, fittings, specialties, and associated equipment shown on the drawings and called for in the specification shall be furnished and installed by the Contractor.

D. This section does not cover exterior underground domestic water and fire service mains, sewers and special piping systems as specified elsewhere.

E. Related Sections include the following:
1. Refer to division 31 section “Earthwork.”

1.2 SUMMARY

A. Section includes the following underground hydronic piping:

1. Carbon steel pipes and fittings.
2. Loose-fill insulation.
3. **Underground pre-insulated steel pipes and fittings.**

1.3 DEFINITIONS

A. Invert: Vertical distance from Project datum reference point to bottom interior pipe surface.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Piping & fittings.
2. Loose-fill insulation.
    a. Submit product testing of product properties in accordance and compliance of ASTM Industry Codes and Standards for items in Section 1.4 “Codes and Standards” and Section 2.4 “Physical Properties”
    b. Long Term Water Retardency Test: Submit passage of 3rd party conducted laboratory testing for minimum of 30 days withstanding moisture penetration.
    c. Submit manufacturer entire warranty, per manufacturer’s current design/installation manual.
    d. Current Published Manufacturer's Design & Installation Manual and Instructions
    e. Manufacturer Statement: Indicating if the material is sold based on bulk density or installed/use density.
3. Anode testing stations.

B. Shop Drawings: For underground hydronic piping. Signed and sealed by a professional engineer.

1. Include calculations showing requirements for expansion compensation for underground piping.
2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement at required locations. Show anchors and guides that restrain piping movement with calculated loads, and show concrete thrust block dimensions.
3. Show pipe sizes, locations, inverts, and pitch. Show piping in trench, piping in conduit, and cased pipe with details showing clearances between piping.
4. Show insulation thickness.

C. Delegated-Design Submittal: For underground hydronic piping systems indicated to comply with performance requirements and design criteria, including analysis data and design drawings signed and sealed by the professional engineer responsible for their preparation.

1. Include design calculations and details for selecting thermal expansion and thrust restraints.

D. The Contractor shall lay out the piping system in careful coordination with the design drawings, determining the proper locations and elevations of all components and using the minimum number of bends to produce a satisfactory functioning system. The Contractor shall follow the general layout of the design drawings in all cases except where other work or structures may interfere.

E. Work shall not begin in shop or field until the Engineer has reviewed and approved the Contractor's shop drawings.

F. Work performed without the approved shop drawings, which requires later changes, shall be promptly replaced without charge to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from hydronic distribution piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and at vertical scale of not less than 1 inch equals 5 feet (1:50).

1. Show locations and inverts of utility system manholes and piping. Show manholes and piping. Show types, sizes, materials, and inverts of other utilities crossing hydronic piping.
2. Show depth of cover from top of hydronic system pipes to finished grade.

C. Qualification Data: For Installer.

D. Welding certificates.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31.9, "Building Services Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

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

C. Loose-fill insulation:

1. Manufacturer’s Qualifications: Firm regularly engaged in the manufacture of granular insulation products of size and type required, whose product has been in satisfactory use in similar service for not less than 10 years.
2. Installers Qualifications: Firm with at least 3 years of successful installation experience on projects with elevated temperature mechanical insulation systems.
3. [If Required] On site supervision of direct buried insulation installation: Provide services of a manufacturer trained representative of the insulation manufacturer for a minimum of Fill In trip(s), to include pre-installation/start-up training and

continued installation supervision. Provide a written report following each site trip. Advise manufacturer of minimum 7-10 days in advance for scheduling.

1.7 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services in accordance with requirements indicated:

1. Notify Construction Manager & Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Construction Manager's written permission.

1.8 COORDINATION

A. Coordinate pipe-fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Carbon steel pipe for chilled water services (underground CWS&R):

1. Materials and installation shall be in accordance with the following industry and association standards:

a. ANSI B31.1 Power Piping Code.
b. ASTM Materials (As Noted).
c. ASME Materials and Welding.

2. The Contractor shall consider, review and confirm the following design criterion in the design and installation of the carbon steel piping systems:

a. Chilled water piping design pressure: 300 psig at 100 °F.
b. Chilled water hydrostatic test pressure: 450 psig.

2.2 STEEL PIPE AND FITTINGS

A. Carbon Steel Pipe:
1. 2-1/2” to 24”: ASTM A53 Grade B, ERT, Std Wt, B.E.

B. Fittings:

1. 2 1/2" and Over: ASTM A234-WPB, Std. Wt., B.E

C. Flanges:
1. 2 1/2" to 24": 150 lb., F.S, ASTM A105, R.F or FF, S.O or WN (use WN for fitting to fitting)

D. Bolting:
1. Carbon Steel ASTM A307 GRB regular hex head and heavy hex nuts.

E. Branch connections:
1. Headers/branches 2-1/2” and over: reducing tee.

F. Joints:
1. Rubber Field Lok 350 Gaset (U.S. Pipe) or approved equal.
2. Restrained mechanical joint (EBAA Megalug) or approved equal, with rubber gasket.

G. Steel Welding Fittings: ASME B16.9 seamless or welded.

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

H. Nipples: ASTM A733, made of same materials and wall thicknesses as pipe in which they are installed.

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

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch- (3.2-mm-) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat face, Class 125, cast-iron and -bronze flanges.
b. Narrow-Face Type: For raised face, Class 250, cast-iron and steel flanges.

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

2.3 LOOSE-FILL INSULATION

A. Gilsulate 500 XR

1. ASTM C177-04 Thermal Conductivity (tested @ use density):
a. K = 0.53 Btu/hr.ft2 °F/in. @ 100 °F Mean Temp
b. K = 0.60 Btu/hr.ft2 °F/in. @ 175 °F Mean Temp
c. K = 0.65 Btu/hr.ft2 °F/in. @ 300 °F Mean Temp
2. ASTM D1895A – Bulk Density
a. 30-34 lbs./ft3

3. ASTM D1895C (400 lbs.) – Consolidated Cubic Foot Installed/Use Density (CFUD)
   a. 40-42 lbs./ft3 CFUD
4. ASTM D1895C (400 lbs.) – Percent of compaction of installed density under static load
   a. Shall not exceed more than 1% compaction
5. ASTM D1895C (12,000 lbs.) – Material Bearing Under Applied Static Loading
   a. 12,000 PSF
6. Particle Sizing Range: “Well-graded” diameter ranging from 1mm to sub-micron sizes
7. Material Stability: Material for direct-buried application must support weight of a man prior to backfill placement.
8. Temperature Range: 35°F to 800°F
9. Electrical Resistivity: Greater than 10 to the 12th Ohm-cm

B. Product must consist of insulating minerals (sodium potassium aluminum silicate) and dielectric mineral filler (coated calcium carbonate). Material shall be dry, free-flowing, inert, inorganic, non-toxic, non-flammable, and completely free of asbestos and fibers. Material to be chemically treated to render it hydrophobic. Product is NOT to rely upon polyethylene barrier to prevent: foreign object/soil intrusion, material protection or direct contact of water. Unified Soil Classification System (USCS) recognizes well-graded and poorly graded materials. Underground fill product must consist of well-graded, multi-sized and shaped particles and raw material must be dimensionally stable. Insulation material must be able to be mechanically compacted.

C. ACCESSORIES

1. Protective Coatings: provide a bitumastic self-priming, heavy duty, cold-applied, waterproof coating made from pitch derived from tar and solvents. Approved product: Carboline® “Bitumastic 50” or equal.
2. Structural Steel Components: provide steel anchors and guides as required by the contract documents and insulation manufacturer's drawings and Design and Installation Manual.
3. Expansion Cushions: provide 3 to 5 pound density mineral fiber cushion to accommodate thermal expansion at expansion loops and elbows as required by the contract documents and insulation manufacturer's drawings and Design and Installation Manual.

D. Insulation at Pipe Joints and Fittings:

1. Provide pipe system manufacturer's recommended joint and fitting seals, with formed, spray, or loose-fill insulation. Provide pipe system manufacturer's recommended sealants and adhesives required to form watertight boundaries at outer conduit.

2.4 UNDERGROUND PRE-INSULATED STEEL PIPES AND FITTINGS

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

1. Perma-pipe, Inc.
2. Insul Tek Piping Systems, Inc
3. Rovanco.
4. Thermacor Process Inc.
5. Thermal Pipe Systems.

B. Description: Factory-fabricated piping with carrier pipe, insulation, and casing. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the pre-insulated piping system manufacturer.

1. Source Limitations: Obtain piping system from single source from single manufacturer.

C. Carrier Pipe: ASTM A-53, Grade B., ERW (Type E) or seamless (Type S), standard weight for sizes 2" and larger. All carbon steel pipe shall have ends cut square and beveled for butt-welding. Straight sections of factory insulated pipe shall have 6" of exposed pipe at each end for field joint fabrication.

D. Carrier Pipe Insulation:

1. Polyurethane Foam Pipe Insulation: Rigid, cellular, and high-pressure injected between carrier pipe and jacket.

a. Comply with ASTM C591; compressive strength of 30 psi, thermal conductivity (k-value) shall not exceed 0.18 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging, 90% minimum closed cell polyurethane with a minimum 2.0 lbs per cubic foot density.

E. Casing: Extruded, black, high-density polyethylene (HDPE), having a wall thickness not less than 100 mils for jacket sizes less than or equal to 12", 125 mils for jacket sizes larger than 12" to 24", and 150 mils for jacket sizes greater than 24". No tape jacket allowed. The inner surface of the HDPE jacket shall be oxidized by means of corona treatment, flame treatment (patent pending), or other approved methods. This will ensure a secure bond between the jacket and foam insulation preventing any ingression of water at the jacket/ foam interface.

F. Casing accessories include the following:

1. Joint Kit: Pressure testable exterior jacket shall be high strength polyethylene sleeve that is electro-fusion welded and field insulated using pourable urethane foam to the thickness specified, preformed split insulation will not be acceptable.

2. Fusion welding shall be done using split sleeves with embedded wires or mesh that is heated with an electro-fusion welder.
3. Joint kit shall be pressure testable to 5 psi.
4. Fusion welder shall have archiving capability.
5. A report showing the temperatures, times, and pressure testing of each joint and its location shall be submitted upon completion.

G. Straight run joints: Shall be insulated with same thickness as the pipe and field-insulated per the manufacturer's instructions, using polyurethane foam poured in an HDPE sleeve and sealed with heat shrink sleeve.

1. All joint closures and insulation shall occur at straight sections of pipe.
2. All insulation and jacketing materials shall be furnished by pre-insulated piping system manufacturer.
3. Heat shrink materials will not be accepted for field joints or the repair of field joints that do not pass pressure tests.
4. All field joints shall be pressure tested to ensure air tightness of 5 psi for 5 minutes while being soap tested for leaks.
5. Joint closure kits shall occur at straight runs only. All fittings shall be pre-manufactured.

H. Fittings: Shall be factory pre-fabricated and pre-insulated fittings with poly-urethane foam to the thickness specified and jacketed with a one-piece seamless molded HDPE fitting cover, a butt fusion welded, or an extrusion welded and mitered HDPE jacket. Carrier pipe fittings shall be butt-welded, except sizes smaller than 2" shall be socket-welded. Fittings include expansion loops, elbows, tees, reducers, and anchors. Elbows, loops, offsets, or any other direction changes shall conform to the standards set by ASME B31.1, Code for Power Piping.

I. Source Quality Control: Factory test carrier pipe to 150 percent of operating pressure of system. Furnish test certificates.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATION

A. Chilled-Water Piping (glycol):

1. NPS 2-1/2 and larger shall be the following:
   a. Schedule 40 welded carbon steel pipe.

b. Loose-Fill Insulation: Granular.

c. Factory pre-insulated with polyurethane and HDPE-jacketed steel piping system.

1) Piping insulation thickness: 1 inch.

3.3 PIPING INSTALLATION

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

B. Restrain every joint.

C. Remove standing water in the bottom of trench.

D. Bed the pipe on a minimum 6-inch (150-mm) layer of pipe system manufacturer's recommended granular fill material with a minimum 6-inch (150-mm) clearance between pipes.

E. Do not backfill piping trench until field quality-control testing has been completed and results approved.

F. Install piping at uniform grade of 0.2 percent. Install required fittings to accommodate capped drains at low points and elsewhere as required for system drainage. Install capped manual air vents at high points.

1. Maintain continuous bedding under piping. Do not leave gaps in pipe bedding, allowing pipe to sag between contact points with the bedding.

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

H. Install piping in straight lines. Do not bend pipe.

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

J. Connect to hydronic piping where it passes through the building wall. Hydronic piping inside the building is specified in Section 232113 "Hydronic Piping."

K. See Section 230523.13 "Butterfly Valves for HVAC Piping" for sleeves and mechanical sleeve seals through exterior building walls.

L. Apply bitumastic coating to carbon-steel anchors and guides. Pour concrete thrust blocks and anchors. See Section 033000 "Cast-in-Place Concrete" for concrete and reinforcement.

M. After field quality-control testing is complete, backfill with 6 inches (150 mm) of clean, granular material in accordance with piping system manufacturer's written instructions. If mechanical compaction is required, manually backfill to 12 inches (300 mm) before using mechanical-compaction equipment.

N. Pre-insulated underground piping systems:

1. Shall be buried in a trench not less than two feet deeper than the top of the pipe and not less than 18 inches wider than the combined OD of all piping systems.

2. Trench bottom shall have a minimum of 6" of sand as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

3.4 LOOSE-FILL INSULATION INSTALLATION

A. Delivery, Storage, and handling

1. Deliver insulation, associated adhesives, form work and supplementary steel to site in manufacturer's containers with manufacturer's stamp or label clearly shown.
2. Protect insulation packaging and associated components against sun, dirt, water and chemical damage.

B. Examination

1. Examine area and conditions under which engineered controlled density insulating fill & corrosion protection system is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected. All standing water shall be removed from trench prior to installing insulation.
2. Pile dirt from trenching on one side of trench and work from opposite side. Insure bottom of trench is free of debris and large stones.
3. Bottom of trench shall be undisturbed soil.

C. Installation

1. Install per manufacture's installation instructions.
2. Install and test carrier pipe: Install and test prior to installing insulation. Inspect welds and pressure test pipe as required by other sections of this specification. Clean pipe of all dirt, scale and foreign materials.
3. Installation of anchors: Install structural steel and concrete of the size and quantity shown on the contract documents. Pour 2000 psi concrete at 28 days around rebar and anchor post and against undisturbed soil. Insure anchor post and support channel (if required) are at the proper elevation for installation of piping. Insure the rebar and the bottom of the anchor post is within the concrete envelope. Just prior to pouring the insulation coat all exposed steel (anchor post,

support channel and knee brace) with bitumastic. Bitumastic must be tacky during insulation.

4. Installation of guides: Install structural steel and concrete of the size and quantity shown on the contract documents. Pour 2000 psi concrete at 28 days around lower portion of guide brackets and against undisturbed soil. Weld the horizontal guide brackets at the proper pipe elevation. Just prior to pouring the insulation coat all exposed steel guide brackets and spacer angles with bitumastic. Bitumastic must be tacky during insulation installation.
5. Installation of expansion loop support: Pour concrete support pad of the size indicated on the contract documents. Insure pad elevation is correct for proper pipe elevation when the concrete pipe support is installed. Coat pipe support with bitumastic. Bitumastic must be tacky during insulation installation.
6. Installation of temporary pipe supports: Provide temporary pipe support wires suspended from lumber bridging the trench. Temporary wood blocks located under the pipe may also be used. These supports must be removed as the insulation is poured and consolidated. No object should be allowed to bridge the gap between the soil and the pipe except the insulation.
7. Installation of expansion cushions: Wrap mineral fiber cushions around pipe elbows on expansion elbows and expansion loops as indicated on the contract documents. Insure there is sufficient space or flexibility between cushions to allow insulation to pour and be consolidated under piping. Secure cushion to pipe with fiber reinforced tape. Specified Insulation thicknesses need to be maintained around fiber cushion areas.
8. Installation of forms: Provide gypsum board forms with support posts as shown in Gilsulate International, Inc.'s Design and Installation Manual. Posts must be located on the outside of the forms and spaced to prevent bowing of the gypsum board. After forms are in place, partially backfill outside of form to height of pipe.
9. Pouring of insulation: Pour insulation in short sections along the pipe axis. Apply bitumastic to structural steel surfaces and fill trench to centerline of pipe. Consolidate insulation using a rod-type concrete vibrator pulled along the sides and between the pipes. Pour and consolidate additional layers of insulation until the design coverage has been achieved. Proper consolidation is achieved when the insulation can be walked on with foot prints less than 1" deep. No wood is to remain in contact with pipe(s) or left in insulation envelope. This could affect overall system efficiency (heat gain/loss) of non-metallic pipe(s) and/or cause corrosion to metallic pipe(s).
10. Inspector must physically be capable of confirming specified installed/compacted insulation thicknesses prior to placement of any backfill.
11. Backfill first 6" of soil (no stones) by hand. Complete backfilling and mechanically compact in uniform layers with suitable excavated soil to grade level.
12. Refer to Gilsulate International Inc. “Design & Installation Manual for Installation Procedures.

3.5 SLEEVES (UNLESS OTHERWISE SPECIFIED)

A. All piping sleeves passing through walls shall be Sch. 40 galvanized steel pipe with piping alignment guides and shall be anchored flush with the wall.

B. Sleeves for pipe passing through outside walls shall be cast iron pipe caulked between pipe and sleeves with waterproof and rodent resistant material. A cover plate or approved device shall be installed on the ends to make the assembly watertight. Linkseal type packing shall be used where specified.

C. Sleeves shall be two sizes larger for pipes up to 2-1/2" IPS, and one size larger for pipes 3" IPS and larger. Sleeves shall include allowance for insulated pipes as required.

D. Wherever specified, sleeves shall be of sufficient size to permit passage of flanges or fittings assembled with the piping.

E. Sleeves shall be set before concrete or masonry is completed, and shall be finished flush with the wall or otherwise specified.

F. Sleeves shall be Link-Seal or equal.

3.6 JOINT CONSTRUCTION

A. Fabrication

1. The ends of all pipes shall be cut square; the faces of all flanges, (slip-on, weld neck, etc.) shall be at 90-degrees to the longitudinal pipe axis on which they are installed.
2. Screwed companion flanges, where used, shall be screwed on tightly with the face of the pipe not protruding, nor back more than 1/16" from the face of the flange.
3. Special joints, where specified (i.e. Dresser Couplings; flared and compression joints; lapped, sweated, brazed and bell-and-spigot joints, etc.) shall be used for services, pressures and temperatures for the particular system to be installed.
4. Fabricators equipped to swage pipe may do so with the specific, written approval of the Owner.
5. Pipe bends, when used, shall be made with radii of not less than six (6) times the normal pipe size, unless otherwise noted for individual systems.
6. Pipe bends shall be made in one plane, true to angle and having a finished surface without distortion, flat spots or less of true circular area.
7. Pipe ends shall have all internal and external burrs removed and shall be free of rust, scale, cuttings, debris, and oxide. All pipe ends shall be reamed after threading.
8. Flange bolt holes shall straddle horizontal and vertical centerlines except where noted on the drawings.

B. Welding

1. All pipe fitters and plumbers must present proof of current ASME certification before doing any welding on this job. All welders shall be approved by the Owner.
2. If ASME certification is used for approval, then a current certification must be presented for each job.
3. The Contractor will be required to remove and remake any weld not properly identified with a die stamped identification code number.
4. The Contractor will be required to cut out sections of piping containing welds, when directed by the Owner's representative, for inspection and testing purposes. If a weld does not pass the Owner's approved standards, the Contractor will be required to replace the test section of piping at no additional cost to the Owner. When a weld is found to be acceptable and meets the Owner's approved standards, the Owner will reimburse the Contractor for the replacement costs, providing the Contractor replaces the test section of piping as directed by the Owner's representative and has the time and material cost slips signed by the Owner's representative.

C. Join pipe and fittings in accordance with the following requirements and Section 232113 "Hydronic Piping":

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1 or ISO 7-1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

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

E. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators, in accordance with "Quality Assurance" Article.

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

G. Pressure seated joints: Use manufacturer recommended tool and procedure. Leave insertion marks on pipe after assembly.

H. Butt fusion: The pipe shall be joint by the butt fusion process outlined in ASTM F2620 or PPI TR-33. All fusion joints shall be made in compliance with manufacturer's recommendations. Fusion joints shall be made by qualified technicians per PPI TN-42.

I. Butt fusion joint recording: The critical parameters of each fusion joint shall be recorded by an electronic data logging device. All fusion joint data shall be included in a fusion technician's joint report.

3.7 IDENTIFICATION

A. Install continuous plastic underground warning tapes during backfilling of trenches for underground hydronic piping. Locate tapes 6 to 8 inches below finished grade, directly over piping. See Section 312000 "Earth Moving" for warning-tape materials and devices and their installation.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Prepare hydronic piping for testing in accordance with ASME B31.9 and as follows:

    a. Leave joints, including welds, uninsulated and exposed for examination during test.
    b. Isolate equipment and instrumentation. Do not subject equipment and instrumentation to test pressure.
    c. Install relief valve set to relieve at pressure no more than one-third higher than test pressure.
    d. Fill system with water. Where there is risk of freezing, perform testing with air or liquid that will not freeze or cause damage to piping system materials.
    e. For hydrostatic testing, install vents at high points to release trapped air while filling system. Remove test liquid at accessible low points.

2. Test hydronic piping as follows:

a. Subject hydronic piping to hydrostatic test pressure that is not less than 1.5 times system design pressure.
b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.
c. Do not pressurize carrier pipe with air.
d. Maintain test pressure for two hours with no loss of pressure.

E. Piping will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. When successful testing is complete, flush carrier piping to remove dirt or debris remaining after construction. Drain piping after flushing is complete.

H. Fill underground piping system with permanent system liquid prior to system testing and balancing.

3.9 CLEANING AND FLUSHING

A. All piping installed under this work package shall be cleaned and flushed as part of the work after hydrostatic or pneumatic testing.

B. The Owner shall furnish the following for cleaning and flushing.

1. Sufficient source of fresh water, steam, and compressed air from existing plant.
2. Target drain for water used for flushing.

C. Contractor shall furnish and install all temporary valves, hoses, and fittings to connect piping systems to water main and sewers. Contractor shall also furnish a temporary back-flow preventer (reduced pressure type) at connection(s) to existing water mains.

D. Contractor shall flush all pipes to clear out debris. The use of cleaning fluids containing chlorine shall be prohibited unless approved by Owner in writing.

E. Contractor shall drain all lines filled with water after flushing.

F. Contractor shall drain all flushing and cleaning water to the existing storm sewers at a maximum flow rate of 500 GPM.

G. Piping systems must be maintained in clean condition at all times. Reasonable pre-cautions shall be taken to prevent entry of foreign material into the piping system.

H. Temporary Piping:

1. On all piping systems requiring cleaning or flushing all operating mechanisms such as valves, cylinders, bearings, etc., shall be disconnected. A spool piece

shall be installed at these points to allow a continuous circulation of cleaning media or flushing fluid. Special care shall be taken to insure that materials not compatible with cleaning fluids are protected.

I. Cleaning Bypass Items:

1. All pump relief valves, system regulation valves, bypass valves and other valves that were closed during flushing shall be removed and thoroughly cleaned.

END OF SECTION 232113.13

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-duct air terminal units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

B. Sustainable Design Submittals:

1. Air terminal units.
2. Sealants and gaskets.
3. Liners and adhesives.

C. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 MANUFACTURERS

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

1. Air terminal units & fan powered boxes:
   a. Anemostast.
   b. Krueger.
   c. Metalaire.
   d. Nailor.
   e. Price.
   f. Titus.
   g. Tuttle and Bailey.

2.3 SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

B. Casing: 0.032-inch-thick galvanized steel, single wall.

1. Casing Liner: Fiber-free foam insulation 3/4-inch thick, R-value of 3.2, and be secured with adhesive; complying with UL 181 (erosion, mold growth, and humidity) requirements, have a maximum flame/smoke spread of 25/50 for both insulation and adhesive when tested in accordance with ASTM E84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

6. Hanger brackets: 12 gauge zinc coated steel for supporting terminal units.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

D. Hydronic Heating Coils: Minimum two row, copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

E. Velocity Sensors: Multipoint sensor with velocity pressure sensing.

1. Differential pressure airflow device measuring total and static pressures. Control tubing shall be protected by grommets at the wall penetration. The airflow sensor shall have pressure sensing ports and static ports, include a center averaging chamber that amplifies the sensed airflow signal. Tubing lines sense pressure

F. Controls: Refer to Division 23 Section “DIRECT DIGITAL (DDC) SYSTEM.”

1. Factory mount all controls with a single point electrical connection.
2. Provide and wire a non-fused disconnect switch.
3. Mount all controls components within a control panel enclosure with a removable cover. Control panel enclosure to be an integral NEMA 250, Type 1 with hinged door or removable cover.
4. Utilize terminal strips and wiring terminations sized according to NFPA 70.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to AHRI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

B. Factory calibrate minimum, maximum, and heating airflow settings.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

E. Trapeze and riser supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

3.2 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install return/exhaust air terminal level and plumb. Maintain sufficient clearance for normal services and maintenance.

D. Install all air terminals such that the top of each unit is no more than 36” above the ceiling.

E. Install wall-mounted thermostats.

F. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

G. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

H. Comply with requirements in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" for connecting ducts to air terminal units.

I. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

J. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Visually inspect all terminal unit liners and replace if not continuous or damaged.

B. Air terminal unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 323342 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial Contour Bench Swing.

B. Related Requirements:

1. Section 012300 “Alternates” for Swing assembly and associated concrete slab.
2. Section 033000 "Cast-in-Place Concrete" for installing pipe in concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.

a. Include concrete footings and post embedment for in-ground mounting.

2. Include accessories, hardware, and operational clearances.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 WARRANTY

A. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMMERCIAL CONTOUR BENCH SWING

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

1. Premier Polysteel, a division of ADA Enterprises, Inc.
2. Taylor & Associates, Inc.
3. UltraSite, a Playcore Company.
4. FS Industries.

B. General Weight Capacity:

1. Support 1000 pounds.

C. Frame: Galvanized structural steel tubing.

D. Seat and Back:

1. Seat Height: 18 inches above grade.
2. Seat Surface Shape: Contoured or dished.
3. Overall Width: 72 inches minimum.
4. Overall Depth: 24 inches minimum.
5. Arms: Two, one at each end.

E. Swing Frame: 2-inch post, schedule 40.

1. Swivel: Galvanized cast iron with bronze bushing.
2. Chain: 3/6-inch proof coil grade 30.
3. Pipe: No holes permitted.

F. Expanded Metal Seat: Hot Rolled steel, 3/4-inch #9 standard.

G. Steel Finish: Galvanized and PVC-color coated.

1. Coating: Plastisol (PVC) Poly-Vinyl Chloride Coating.

a. Resistance to Fungal Growth: Antimicrobial (non-leaching) per ASTM G21-90.
b. Tensile Strength: no less than 1800 psi per ASTM D412.
c. Elongation: No less than 200% per ASTM D412.
d. Tear Strength: No less than 300lb/in per ASTM D624.
e. Hardness: 90+/- 5 (durometer, Shore A (Instant)) per ASTM D2240.
f. Flammability: Pass per FMVSS 302.
g. UV Stabilized: No fading for five (5) years per written warranty.
h. Thickness: 0.125 inches – 0.25 inches.

2. Color: As selected by Architect from manufacturer's full range.

H. Hardware: 305 stainless steel.

I. Mounting: Post embedded in concrete footings per manufacturer’s determination to accommodate weight capacity.

2.2 MATERIALS

2.3 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 323342

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GENERAL SPECIFICATIONS

1. ALL WORK PERFORMED ON THE SITE SHALL CONFORM TO THE SITE CONSTRUCTION PLANS AND SPECIFICATIONS. SITE CONSTRUCTION SHALL BE IN CONFORMANCE WITH APPLICABLE FEDERAL, STATE, COUNTY, CITY OR LOCAL AGENCY ORDINANCE REQUIREMENTS, STANDARDS, SPECIFICATIONS, AND DETAILS. WHEN CONFLICTING SPECIFICATIONS ARE FOUND, REPORT TO ENGINEER IMMEDIATELY FOR CLARIFICATION; GENERALLY THOSE SPECIFICATIONS AND DETAILS FOUND IN THE APPLICABLE LOCAL GOVERNMENT JURISDICTION CONSTRUCTION GUIDELINES SHALL PREVAIL IN THE EVENT OF A DISCREPANCY.

2. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND APPROVALS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. TIMELY NOTIFICATION OF GOVERNMENTAL AGENCIES REGARDING THE COMMENCEMENT OF CONSTRUCTION ACTIVITY IS REQUIRED. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO COORDINATE WITH THE OWNER AND TO VERIFY THAT ALL PERMITS HAVE BEEN OBTAINED, AND THAT ALL GOVERNMENTAL AGENCIES HAVE BEEN NOTIFIED. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO COORDINATE WITH OWNER AND ENGINEER.

3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY LOCAL PERMITS REQUIRED FOR CONSTRUCTION IN PUBLIC RIGHT-OF-WAY OR ANY OTHER PERMITS REQUIRED BY THE LOCAL REGULATORY AGENCIES TO COMPLETE THE CONSTRUCTION AS DETAILED IN THESE PLANS. THE OWNER OR HIS REPRESENTATIVE WILL AID THE CONTRACTOR IN OBTAINING SUCH PERMITS AS MAY BE NECESSARY.

4. A MINIMUM OF 48 HOURS NOTICE WILL BE PROVIDED TO THE APPROPRIATE GOVERNMENTAL AGENCY PRIOR TO CONSTRUCTION, RESTART, OR CHANGE OF OPERATION AND SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR MUST FURTHER NOTIFY THE CITY ENGINEER'S OFFICE 48 HOURS PRIOR TO ANY CONSTRUCTION ACTIVITY (INCLUDING UTILITY INSTALLATION) WITHIN EXISTING RIGHT-OF-WAY TO SCHEDULE INSPECTION. ANY WORK WITHIN SAID RIGHT-OF-WAY THAT HAS NOT BEEN INSPECTED WILL BE REJECTED.

5. ANY UTILITY CONNECTIONS THAT REQUIRE CONSTRUCTION WITHIN STATE OF INDIANA RIGHT-OF-WAY SHALL REQUIRE AN INDOT LINE CUT PERMIT. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH ENGINEER AND OWNER TO COMPLETE THE PERMIT.

6. A PRE-CONSTRUCTION CONFERENCE INCLUDING THE OWNER, ARCHITECT, ENGINEER, CONTRACTOR, GOVERNMENT OFFICIALS, REPRESENTATIVES OF PRIVATE UTILITY COMPANIES, AND OTHER INTERESTED PARTIES SHALL BE HELD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

7. THE OWNER OR HIS REPRESENTATIVE SHALL NOTIFY ALL UTILITY COMPANIES AND THE CONTRACTOR BEFORE THE PRECONSTRUCTION MEETING. NO CONSTRUCTION WILL BEGIN UNTIL SAID PRECONSTRUCTION MEETING HAS BEEN HELD.

8. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN FIELD BEFORE STARTING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FIELD DIMENSIONS. IF ANY DISCREPANCIES ARE FOUND IN THESE PLANS FROM ACTUAL FIELD CONDITION, THE CONTRACTOR SHALL CONTACT ENGINEER IMMEDIATELY.

9. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING FEATURES WHICH LIE ALONG THE PERIMETER OF THE SITE. THESE FEATURES INCLUDE, BUT ARE NOT LIMITED TO: BUILDINGS, PAVEMENTS, FENCES, VEGETATION, UTILITIES, PROPERTY MARKERS, ETC. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE WHICH OCCURS DURING OR AS A RESULT OF CONSTRUCTION ACTIVITY. REPLACEMENT OF DAMAGED PROPERTY SHALL BE EQUAL TO EXISTING CONDITIONS.

10. UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE LOCATIONS AS LOCATED BY THE VARIOUS UTILITY COMPANIES. CONTRACTOR SHALL VERIFY LOCATION OF ALL UNDERGROUND UTILITIES PRIOR TO EXCAVATION. DURING CONSTRUCTION, ALL UTILITIES SHALL BE ADEQUATELY SUPPORTED TO MINIMIZE DAMAGE. CONTRACTOR SHALL CONTACT THE APPROPRIATE UTILITY OR GOVERNMENTAL AGENCY IMMEDIATELY IF ANY DAMAGE TO EXISTING UTILITIES OCCURS AND SHALL BE RESPONSIBLE FOR REPAIRING THE UTILITY IN ACCORDANCE WITH THE AFFECTED UTILITY'S REPAIR POLICY.

11. THE CONTRACTOR SHALL NOTIFY INDIANA UNDERGROUND PLANT PROTECTION SERVICES, "INDIANA811", FORTY-EIGHT (48) HOURS IN ADVANCE OF ANY EXCAVATION BY CALLING 1-800-382-5544 OR 811, OR ON THE INTERNET AT WWW.CALL811.COM. IN ACCORDANCE WITH I.C. 8-1-26, ALL EXCAVATIONS WITHIN 24" INCHES OF EXISTING UTILITY INSTALLATIONS SHALL BE PERFORMED BY HAND EXCAVATION, AIR CUTTING, OR VACUUM EXCAVATION.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING SAFE TRAFFIC CONTROL ON THE ADJACENT PUBLIC STREETS, AS RELATED TO BOTH PHYSICAL SITE IMPROVEMENTS AND THE MOVEMENT OF CONSTRUCTION TRAFFIC. CONSTRUCTION TRAFFIC SHALL ENTER AND EXIT THE SITE FROM THE CONSTRUCTION ENTRANCE AS SHOWN ON THE STORM WATER POLLUTION PREVENTION PLAN.

13. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOBSITE AND SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. ALL CONSTRUCTION ACTIVITY AND SAFETY PROVISIONS SHALL CONFORM TO ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, ORDINANCES AND CODES. ALL TRENCHING, PIPE LAYING AND BACKFILLING OPERATIONS SHALL BE IN ACCORDANCE WITH OSHA REGULATIONS.

14. SUFFICIENT SHEETING, SHORING AND BRACING SHALL BE PROVIDED BY THE CONTRACTOR TO ENSURE SAFETY OF THE WORKMEN AND WHEREVER IT IS NECESSARY TO PROTECT AND PRESERVE LIFE, STRUCTURES AND PROPERTY AND COMPLETE THE WORK IN THESE PLANS. THE DESIGN AND INSTALLATION OF SUCH DEVICES SHALL BE COMPLETED UNDER THE DIRECT SUPERVISION OF A QUALIFIED INDIVIDUAL EXPERIENCED IN SUCH WORK.

15. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE AT HIS EXPENSE ALL AUTOMOBILE AND PEDESTRIAN TRAFFIC CONTROL DEVICES REQUIRED BY FEDERAL, STATE, COUNTY, CITY OR LOCAL AGENCY. THE AMOUNT, LOCATION AND SIZE SHALL BE PER DIRECTION OF AGENCY.

16. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REMOVE ALL MUD, DIRT, GRAVEL, AND ANY OTHER MATERIALS TRACKED ONTO ANY PUBLIC OR PRIVATE STREETS OR SIDEWALKS. THE CONTRACTOR MUST CLEAN THESE DAILY IF NECESSARY. THE CONTRACTOR MUST USE WATER OR OTHER METHODS TO KEEP AIRBORNE DUST TO A REQUIRED MINIMUM. NO METAL DUMPSTERS SHALL BE PLACED ON STREETS OR PAVED AREAS AFTER CONSTRUCTION.

17. SITE CONSTRUCTION LAYOUT FOR BUILDING FOUNDATIONS, CURBS, STREETS, WATER MAINS, DRAINAGE SWALES, STORM SEWER STRUCTURES, AND SANITARY SEWER MANHOLES SHALL BE FURNISHED BY THE CONTRACTOR AND PERFORMED BY A COMPETENT, TRAINED AND CAPABLE INDIVIDUAL. ANY IMPROVEMENTS TIED OR IN RELATIONSHIP TO THE PROJECT BOUNDARY LINE SHALL BE PERFORMED BY OR UNDER THE SUPERVISION OF A PROFESSIONAL SURVEYOR REGISTERED AND LICENSED IN THE STATE OF INDIANA AND SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN 865 IAC 1-12-5.

18. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING AND COORDINATING INSPECTIONS WITH THE APPROPRIATE GOVERNMENTAL AGENCY OR UTILITY IN ACCORDANCE WITH SAID AGENCY'S OR UTILITY'S REQUIREMENTS AND STANDARDS. ALL NECESSARY INSPECTIONS AND CERTIFICATIONS REQUIRED BY ORDINANCE, CODE, UTILITY COMPANIES OR GOVERNMENTAL AGENCIES SHALL BE PERFORMED BEFORE THE FINAL CONNECTION OF SERVICES. THE CONTRACTOR SHALL HAVE ALL WORK OPEN TO INSPECTION OF ALL AGENCIES HAVING JURISDICTION OVER THE PROJECT. CONSTRUCTION WORK SHALL CONFORM TO THE REQUIREMENTS OF SAID AGENCIES. THE CONTRACTOR SHALL PROVIDE SAFE ACCESS TO THE CONSTRUCTION SITE FOR ALL INSPECTORS AND SHALL PROVIDE MATERIAL SAMPLES FOR TESTING, AS REQUIRED.

19. TOPOGRAPHIC AND EXISTING SITE INFORMATION SHOWN IN THESE PLANS HAS BEEN PROVIDED BY THE OWNER AND THE CONTRACTOR ACCEPTS SUCH INFORMATION BY ACCEPTING THIS CONTRACT. IF THE CONTRACTOR BELIEVES A SIGNIFICANT CONFLICT EXISTS BETWEEN SUCH TOPOGRAPHIC INFORMATION AND THE ACTUAL SITE CONDITIONS, HE SHALL SUBMIT A TOPOGRAPHIC SURVEY COMPLETED AND CERTIFIED BY A LAND SURVEYOR REGISTERED IN THE STATE OF INDIANA PRIOR TO THE BEGINNING OF ANY CONSTRUCTION AT THE SITE FOR THE OWNER'S REVIEW. FURTHERMORE, THE CONTRACTOR SHALL INFORM HIMSELF OF THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED, THE SITE OF THE WORK, THE OBSTACLES WHICH MAY BE ENCOUNTERED, AND ALL OTHER RELEVANT MATTERS CONCERNING THE WORK TO BE PERFORMED. THE CONTRACTOR SHALL NOT BE ALLOWED ANY EXTRA COMPENSATION BY REASON OF ANY MATTER OR THING WHICH THE CONTRACTOR MIGHT HAVE FULLY INFORMED HIMSELF, BECAUSE OF HIS FAILURE TO HAVE SO INFORMED HIMSELF PRIOR TO BIDDING THE JOB. IT IS UNDERSTOOD AND AGREED THAT THE OWNER DOES NOT WARRANT OR GUARANTEE THAT THE MATERIALS AND CONDITIONS ENCOUNTERED DURING CONSTRUCTION WILL BE THE SAME AS INDICATED BY THE INFORMATION SHOWN ON THESE DRAWINGS. THE CONTRACTOR MUST SATISFY HIMSELF REGARDING THE CHARACTER, QUANTITIES, AND CONDITIONS OF THE VARIOUS MATERIALS AND WORK TO BE DONE.

20. ELEVATIONS OF ALL EXISTING FACILITIES SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION.

21. IN GENERAL, ALL OPEN TRENCHES OR SIMILAR EXCAVATIONS SHALL BE FILLED AT THE END OF THE DAY'S WORK OR OTHER SPECIFIC OPERATIONS. WHEN THIS IS NOT POSSIBLE OR PRACTICAL, ALL OPEN TRENCHES OR SIMILAR EXCAVATIONS SHALL BE ADEQUATELY FENCED OR "CAUTION" TAPED AT THE END OF EACH DAY'S WORK OR DURING OTHER TIMES WHEN THE CONTRACTOR IS NOT ACTIVELY WORKING AT THE SITE.

22. CONTRACTOR SHALL INDEMNIFY AND SAVE AND HOLD OWNER HARMLESS FROM ANY LOSS, COSTS, CLAIMS OR EXPENSES (INCLUDING BUT NOT LIMITED TO, ATTORNEY'S FEES AND COURT COSTS) ARISING OUT OF OR IN CONNECTION WITH ANY MECHANICS' LIEN FILED BY A SUBCONTRACTOR OR MATERIAL OR EQUIPMENT SUPPLIER ENGAGED OR EMPLOYED IN CONNECTION WITH THE WORK IN THESE PLANS OR WITH SUBSEQUENT CHANGE ORDERS; EXCEPT THIS INDEMNIFICATION SHALL NOT BE ENFORCEABLE DURING ANY PERIOD OF TIME THAT THE OWNER IS IN DEFAULT IN FAILING TO MAKE PAYMENTS WHEN DUE THE CONTRACTOR UNDER THEIR MUTUAL AGREEMENT.

23. ANY BONDS OR INSURANCE REQUIRED BY ANY GOVERNMENTAL AGENCY, UTILITY OR OTHER AGENCY FOR THE COMPLETED WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

24. ALL AREAS DISTURBED BY THE CONSTRUCTION PROCESS SHALL BE RESTORED TO THE CONDITION THAT EXISTED PRIOR TO CONSTRUCTION, AS APPLICABLE. BACKFILLING SHALL BE TO THE GRADE OF THE EXISTING GROUND LEVEL OR TO THE GRADE AS ESTABLISHED BY THE PROPERTY OWNER IN THE EVENT THE PROPERTY OWNER PERMITS THE DEPOSIT OF EXCESS MATERIAL UPON HIS LAND, UNLESS SPECIFICALLY DIRECTED OTHERWISE IN THESE PLANS.

25. THE CONTRACTOR SHALL CONFINE HIS WORK TO THE PROPERTY AND CONSTRUCTION LIMITS SHOWN IN THESE PLANS AND WITHIN APPLICABLE PUBLIC RIGHT-OF-WAY AND EASEMENT LIMITS. IF THE METHODS OF CONSTRUCTION EMPLOYED BY THE CONTRACTOR ARE SUCH AS TO REQUIRE THE USE OF ANY ADDITIONAL LAND, HE SHALL MAKE HIS OWN ARRANGEMENTS WITH THE PROPERTY OWNERS AFFECTED FOR THE USE OF SUCH ADDITIONAL LAND.

GENERAL SPECIFICATIONS CONTINUED

26. IN THE EVENT THAT THE OWNER LETS OTHER CONTRACTS IN CONNECTION WITH THE WORK OF THE CONTRACTOR, THE CONTRACTOR SHALL COOPERATE WITH OTHER CONTRACTORS WITH REGARD TO STORAGE OF MATERIALS AND EXECUTION OF THEIR WORK.

27. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND EQUIPMENT INSTALLED ON THE PROJECT SHALL BE NEW AND BOTH WORKMANSHIP AND MATERIAL SHALL BE OF GOOD QUALITY. MANUFACTURED MATERIALS AND EQUIPMENT SHALL BE APPLIED, INSTALLED AND CONSTRUCTED AS DIRECTED BY THE MANUFACTURER'S GUIDELINES AND RECOMMENDATIONS. WHEREVER PROPRIETARY EQUIPMENT IS SPECIFIED OR "APPROVED EQUAL" IS IMPLIED, ALL PROPOSALS FOR SUBSTITUTION SHALL BE SUBMITTED TO THE APPROPRIATE AGENCY IN WRITING FOR THEIR APPROVAL.

28. UPON FAILURE TO PERFORM THE WORK IN ACCORDANCE WITH THESE CONSTRUCTION PLANS AND SPECIFICATIONS, AND AFTER FIVE (5) DAYS WRITTEN NOTICE TO THE CONTRACTOR, THE OWNER MAY, WITHOUT PREJUDICE TO ANY OTHER REMEDY HE MAY HAVE, CORRECT SUCH DEFICIENCIES IN WORK INTENDED TO BECOME A PERMANENT PART OF THE PROJECT. THE COST TO CORRECT SUCH DEFICIENCIES MAY BE DEDUCTED FROM THE PAYMENT DUE THE CONTRACTOR.

29. THE OWNER SHALL HAVE THE AUTHORITY TO SUSPEND THE WORK WHOLLY OR IN PART, FOR SUCH PERIOD OR PERIODS AS HE MAY DEEM NECESSARY DUE TO UNSUITABLE WEATHER OR SUCH OTHER CONDITIONS AS ARE CONSIDERED UNFAVORABLE TO CARRY OUT THE PROVISIONS OF THE WORK.

30. THE CONTRACTOR, PROMPTLY AFTER BEING AWARDED THE CONTRACT, SHALL PREPARE AND SUBMIT FOR THE OWNER'S AND SURVEYOR'S INFORMATION A CONTRACTOR'S CONSTRUCTION SCHEDULE FOR THE WORK. THE CONTRACTOR SHALL PERFORM THE WORK ACCORDING TO SAID SCHEDULE AS MUCH AS POSSIBLE.

31. THE CONTRACTOR IS RESPONSIBLE TO THE OWNER FOR THE WORK OF HIS SUBCONTRACTORS, AS APPLICABLE, AND OF THEIR DIRECT AND INDIRECT EMPLOYEES TO THE SAME EXTENT AS HE IS RESPONSIBLE FOR THE WORK OF HIS EMPLOYEES. THE CONTRACTOR SHALL BIND ANY SUBCONTRACTOR BY THE TERMS OF THESE CONSTRUCTION PLANS AND SPECIFICATIONS.

32. THE CONTRACTOR SHALL REMOVE FROM THE OWNER'S PROPERTY, AND FROM ALL PUBLIC AND PRIVATE PROPERTY, ALL TEMPORARY STRUCTURES, RUBBISH, AND WASTE MATERIALS RESULTING FROM HIS OPERATION OR CAUSED BY HIS EMPLOYEES, ALL OF HIS EQUIPMENT, TOOLS AND SUPPLIES, AND ALL SURPLUS MATERIALS (UNLESS OTHERWISE DIRECTED IN THESE PLANS OR DIRECTED BY THE OWNER) LEAVING THE SITE SMOOTH, CLEAN AND TRUE TO LINE AND GRADE.

33. ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THESE CONSTRUCTION PLANS AND SPECIFICATIONS AND SHALL BE COMPLETED UNDER THE DIRECT SUPERVISION OF THE CONTRACTOR. CHANGE ORDERS OR REVISED CONSTRUCTION PLANS SHALL BE AS APPROVED BY THE OWNER AND ANY APPLICABLE GOVERNMENT AGENCY OR UTILITY AND MAY BE ISSUED BY THE OWNER PRIOR TO THE COMPLETION OF THE PORTION OF THE WORK AFFECTED BY SUCH CHANGE. PAYMENT FOR CHANGE ORDERS SHALL BE AS NEGOTIATED BY THE CONTRACTOR AND THE OWNER PRIOR TO BEGINNING SUCH WORK. THE MOST RESTRICTIVE OF THE FOLLOWING TOLERANCE SPECIFICATIONS SHALL APPLY TO ALL INFRASTRUCTURE CONSTRUCTED ON THIS PROJECT: (A.) CONTRACTOR SHALL COMPLETE FINISHED GRADING AND PUBLIC IMPROVEMENTS, SUCH AS SEWERS AND STREETS, TO WITHIN 0.1 FEET OF THE ELEVATIONS CONTAINED IN THESE PLANS. (B.) CONTRACTOR SHALL COMPLETE INSTALLATION OF STREET AND SEWER TO THE GRADES (SLOPES) CONTAINED IN THESE PLANS SUCH THAT THEY DEVIATE BY NO MORE THAN 10% FROM THEIR DESIGN GRADE (SLOPE)-E.G. A DESIGN GRADE OF 0.50% SHALL BE CONSTRUCTED BETWEEN 0.45% AND 0.55%. THE CONTRACTOR SHALL BE REQUIRED TO REWORK ANY AREA THAT DOES NOT MEET THESE TOLERANCES AT HIS EXPENSE UNTIL COMPLIANCE IS OBTAINED.

THIS SPECIFICATION DOES NOT ALLOW THE ENTIRE PROJECT TO BE CONSTRUCTED AT SUCH LIMITS (E.G. CONSTRUCT THE ENTIRE PROJECT 0.1-FOOT BELOW DESIGN ELEVATIONS). IN GENERAL, CONTRACTOR SHALL CONSTRUCT STRICTLY TO THE DESIGN GRADES AND ELEVATIONS CONTAINED IN THESE PLANS BUT THE ABOVE LIMITS ARE BEING ESTABLISHED AS A MINIMUM CONSTRUCTION REQUIREMENT TO ENSURE PROPER DRAINAGE AND FUNCTIONALITY OF THE CONSTRUCTED INFRASTRUCTURE. DEVIATIONS IN EXCESS OF THESE LIMITS REQUIRE APPROVAL OF THE OWNER AND ENGINEER/SURVEYOR AND/OR GOVERNMENTAL AGENCY OR UTILITY HAVING JURISDICTION OVER THE PROJECT AND WILL BE GRANTED ONLY IF PROPER FUNCTIONALITY OF THE INFRASTRUCTURE CAN BE SHOWN AND ALL APPLICABLE COVER, SEPARATION, AND OTHER CONSTRUCTION REQUIREMENTS SPECIFIED IN THESE PLANS ARE MET.

34. THE OWNER SHALL HAVE THE RIGHT TO TAKE POSSESSION OF AND USE ANY COMPLETED OR PARTIALLY COMPLETED PORTION OF THE WORK AS NEGOTIATED WITH THE CONTRACTOR PRIOR TO ACCEPTANCE OF THE WORK. SUCH POSSESSION AND USE SHALL IN NO CASE BE DEEMED ACCEPTANCE OF ANY WORK NOT IN COMPLIANCE WITH THESE PLANS AND SPECIFICATIONS.

35. ANY PLAN CONFLICTS SHALL BE SUBMITTED IN WRITING IMMEDIATELY TO FORESIGHT CONSULTING FOR REVIEW.

36. AS-BUILT CONSTRUCTION DRAWINGS SHALL BE FURNISHED TO THE OWNER BY THE CONTRACTOR AND SHALL BE PERFORMED BY A LAND SURVEYING FIRM WITH A LAND SURVEYOR REGISTERED IN THE STATE OF INDIANA. THE CONTRACTOR SHALL ASSIST THE OWNER IN PREPARING THE AS-BUILT DRAWINGS AND SHALL BE REQUIRED TO KEEP AN AS-BUILT RECORD DURING CONSTRUCTION AND INFORMATION REQUIRED FOR PREPARING SUCH RECORD SHALL BE RECORDED PRIOR TO THE BACKFILLING OF THE UNDERGROUND FACILITY. SEE SPECIFIC SECTIONS ELSEWHERE IN THESE SPECIFICATIONS FOR SPECIFIC AS-BUILT INFORMATION REQUIRED. AS-BUILT FIELD DATA SHALL BE COLLECTED AND DRAWINGS SHALL ONLY BE COMPLETED AND ISSUED ONCE. ANY EXPENSE FOR ADDITIONAL FIELD DATA OR REISSUANCE OF AS-BUILTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

DEMOLITION SPECIFICATIONS

1. CONTRACTOR SHALL USE REASONABLE MEASURES TO MINIMIZE DISTURBANCE OF BUILDINGS, TREES, VEGETATION AND SITE IMPROVEMENTS ADJACENT TO CONSTRUCTION AREAS. OWNER SHALL DESIGNATE SUITABLE AREAS WITHIN THE PROPERTY FOR USE IN THE STORAGE, STAGING AND STOCKPILING OF MATERIALS. EXCAVATION, TRENCHING, AND USE OF HEAVY EQUIPMENT ON THE GROUND UNDER TREES TO BE PRESERVED SHALL BE MINIMIZED.

2. TREE PROTECTION SHALL BE IN PLACE FOR THE TREES THAT WILL BE SAVED BEFORE CONSTRUCTION BEGINS. FENCING SHALL BE INSTALLED AT LEAST TO THE DRIP LINE OF THE TREES TO PROTECT THE ROOT ZONE. NO EQUIPMENT SHALL BE ALLOWED TO DRIVE OVER THAT ROOT ZONE. NO STORAGE OF MATERIALS OR VEHICLES SHALL BE ALLOWED WITHIN THE FENCE LINE.

3. BRUSH, TREES, STUMPS AND GRUBBING DEBRIS SHALL BE REMOVED AS NECESSARY TO COMPLETE THE WORK IN THESE PLANS OR AS MAY BE DIRECTED BY THE OWNER. NO ON-SITE DISPOSAL SHALL BE ALLOWED. NO BURNING SHALL BE ALLOWED. EXISTING TREES ON THE SITE SHALL BE PRESERVED AT THE OWNER'S DISCRETION.

4. DISPOSAL AND REMOVAL OF MATERIALS FROM SITE SHALL BE IN ACCORDANCE WITH APPLICABLE STATE AND FEDERAL GUIDELINES.

5. WHEN SAW CUTTING EXISTING CONCRETE PAVEMENT, CONTRACTOR SHALL LOCATE SAWCUTS ALONG EXISTING EXPANSION JOINTS WHEN FEASIBLE.

△1 EARTHWORK, SUBGRADE, TRENCHING, AND BUILDING PAD SPECIFICATIONS

1. EARTHWORK SHALL BE COMPLETED IN ACCORDANCE WITH SECTION 200 OF THE INDOT "STANDARD SPECIFICATIONS", LATEST EDITION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER'S OFFICE AND THE OWNER AT LEAST 48 HOURS BEFORE BEGINNING EXCAVATION AND EMBANKMENT CONSTRUCTION.

2. CONTRACTOR SHALL COMPLY WITH ALL STATE AND LOCAL STORM WATER POLLUTION PREVENTION ORDINANCES THAT APPLY. ALL EROSION AND SEDIMENT CONTROL MEASURES AND DEVICES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THIS PROJECTS STORM WATER POLLUTION PREVENTION PLAN.

3. THE CONTRACTOR SHALL EMPLOY A QUALIFIED GEOTECHNICAL ENGINEER FOR THE INSPECTION OF ALL BUILDING PADS AND FOR THE INSPECTION OF SUBGRADES AND COMPACTED FILLS AS REQUIRED BY THESE SPECIFICATIONS. THE GEOTECHNICAL ENGINEER WILL INSPECT SOIL CONDITIONS, PROOF-ROLLING, AND FIELD DENSITY OF COMPACTED FILLS. ALL SUBGRADES AND FILLS SHALL MEET OR EXCEED THE SPECIFIED DENSITIES, AS DISCUSSED BELOW. BASED UPON REPORTS FROM THE GEOTECHNICAL ENGINEER, SUBGRADES OR FILLS WHICH ARE BELOW SPECIFIED DENSITIES WILL REQUIRE ADDITIONAL COMPACTION WORK AND TESTING AT NO ADDITIONAL EXPENSE TO THE OWNER. COMPACTION TESTS SHALL BE TAKEN AT RANDOM INTERVALS AND ELEVATIONS THROUGHOUT THE FILL EMBANKMENTS.

△1 4. EXCESS MATERIAL FROM THE EXCAVATIONS AND MASS EARTHWORK OR CLEARED MATERIAL UNSUITABLE FOR FILLING SHALL BE REMOVED FROM THE SITE TO A PROPER PERMITTING LOCATION. DISPOSAL SHALL BE DOCUMENTED AND DONE SO AT THE CONTRACTOR'S EXPENSE.

5. CONTRACTOR SHALL INCLUDE A SEPARATE ITEM IN HIS BID SHOWING THE ANTICIPATED EARTHWORK QUANTITIES (NET EXCESS ONSITE OR IMPORT MATERIAL TO CONFORM TO THIS GRADING PLAN) AND SHALL COORDINATE REMOVAL AND/OR TEMPORARY STOCKPILING OF EXCESS ONSITE MATERIALS WITH THE OWNER PRIOR TO ACCEPTING THE JOB. IN ANY CASE WHEN EXCESS ONSITE MATERIAL IS ANTICIPATED, CONTRACTOR SHALL INCLUDE A SEPARATE AND ADDITIONAL ITEM IN HIS BID FOR REMOVAL OF EXCESS ONSITE MATERIAL.

6. CONTRACTOR SHALL BE RESPONSIBLE FOR GRADING THE SITE IN ACCORDANCE WITH THE GRADING PLANS CONTAINED IN THIS CONSTRUCTION SET. ANY REMAINING TOPSOIL STOCKPILES AND OVERBURDEN MATERIAL SHALL BE REMOVED FROM THE SITE UPON COMPLETION OF THE PROJECT. CONTRACTOR SHALL NOT BE ALLOWED ANY EXTRA COMPENSATION FOR SATISFYING THIS SPECIFICATION.

EARTHWORK, SUBGRADE, TRENCHING, AND BUILDING PAD SPECIFICATIONS CONTINUED

8. CONSTRUCTION AS-BUILT DRAWINGS SHALL INCLUDE AS-BUILT ELEVATIONS FOR DRAINAGE SWALES SERVING MORE THAN THEIR OWN SINGLE LOT, CONTOURS ON A ONE-FOOT INTERVAL, AND AS-BUILT STORM SEWER SYSTEM, TOP OF CASTING AT INVERT ELEVATIONS.

9. CONTRACTOR SHALL ENSURE THAT POSITIVE DRAINAGE IS ACHIEVED ON ALL FINAL SURFACES. IN THE EVENT OF GRADING DISCREPANCIES ON THIS PLAN, CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY FOR RESOLUTION.

10. THE EXCAVATING CONTRACTOR MUST TAKE PARTICULAR CARE WHILE EXCAVATING AROUND EXISTING TREES SO NOT TO DISTURB AND TO MINIMIZE OR ELIMINATE DAMAGE TO ROOT SYSTEM.

11. THE EXCAVATING CONTRACTOR MUST TAKE PARTICULAR CARE WHEN EXCAVATING IN AND AROUND EXISTING UTILITY LINES AND EQUIPMENT. VERIFY COVER REQUIREMENTS BY UTILITY CONTRACTORS AND/OR UTILITY COMPANIES SO NOT TO CAUSE DAMAGE.

12. CONTRACTOR WILL REMOVE TOPSOIL FROM ALL AREAS OF EXCAVATION AND WITHIN 3 FEET OF BACK OF CURB OR BUILDING PADS AND STOCKPILE ON SITE AT A LOCATION DESIGNATED IN THESE PLANS OR AS PRESCRIBED BY THE OWNER. DURING FINAL LOT GRADING CONTRACTOR WILL RETRIEVE TOPSOIL FROM STOCKPILE AND SPREAD ONTO THE LANDSCAPED AREAS, AND ANY OTHER AREAS REQUIRING PERMANENT SEEDING.

13. TOPSOIL SHALL BE STRIPPED AND STOCKPILED FOR USE DURING FINISH GRADING AND LANDSCAPE WORK. TOPSOIL IS DEFINED AS FERTILE, FRIABLE NATURAL LOAM SURFACE SOILS, REASONABLY FREE OF SUBSOIL, CLAY LUMPS, BRUSH, AND OTHER LITTER OR STONES LARGER THAN 1/2 INCH. LOOSE DEBRIS, TOPSOILS AND UNSUITABLE SUBSOILS SHALL BE STRIPPED FROM AREAS OF THE SITE THAT ARE TO BE DEVELOPED. THE CONTRACTOR SHOULD REVIEW THE GEOTECHNICAL REPORT, AS THE DEPTH OF STRIPPING OF SURFACE SOILS MAY VARY BY LOCATION WITHIN THE SITE. THE ENGINEER SHALL DESIGNATE ON-SITE LOCATIONS TO STORE OR DEPOSIT STRIPPED SOILS. CONTRACTOR SHALL REMOVE TOPSOILS AND UNSUITABLE SUBSOILS FROM ALL AREAS TO BE OCCUPIED BY BUILDINGS AND PAVEMENTS. IN ADDITION, ANY AREAS TO BE UTILIZED AS BORROW AREAS FOR FILL MATERIAL MUST ALSO BE STRIPPED OF TOPSOILS. A MINIMUM OF 6 INCHES OF TOPSOIL SHALL BE REPLACED IN LAWN AND LANDSCAPED AREAS. IF THE AMOUNT OF STOCKPILED TOPSOIL EXCEEDS QUANTITY REQUIRED, THE EXCESS SHALL BE SPREAD ON THE SITE WHERE DIRECTED BY THE ENGINEER.

14. AFTER THE PAVEMENT AREAS HAVE BEEN STRIPPED, FILLED, AND COMPACTED, THESE AREAS SHALL BE PROOF-ROLLED WITH A MEDIUM WEIGHT ROLLER OR EQUIVALENT EQUIPMENT TO DETERMINE IF ANY POCKETS OF SOFT, YIELDING, OR UNSUITABLE MATERIAL ARE PRESENT. THE GEOTECHNICAL ENGINEER OR A REPRESENTATIVE APPOINTED BY THE OWNER AND APPROVED BY THE ENGINEER SHALL BE PRESENT FOR THE PROOF-ROLLING. IF UNSUITABLE MATERIALS ARE ENCOUNTERED, THEY SHALL BE REMOVED AND REPLACED WITH SPOT SUBGRADE REINFORCEMENT OR COMPACTABLE GRANULAR FILL.

15. SUBGRADE REPLACEMENT SHALL BE ILLUSTRATED ON AS-BUILT DRAWINGS AND SHALL INCLUDE THE DEPTH, TYPE OF GRANULAR FILL UTILIZED AND AREA.

16. WHERE B BORROW IS SPECIFIED IN THESE PLANS, DETAILS, OR SPECIFICATIONS, IT SHALL BE DEFINED AS FOLLOWS: THE MATERIAL USED FOR SPECIAL FILLING SHALL BE OF ACCEPTABLE QUALITY, FREE FROM LARGE OR FROZEN LUMPS, WOOD, OR OTHER EXTRANEOUS MATTER. IT SHALL CONSIST OF SUITABLE SAND, 20 GRAVEL, CRUSHED STONE, ACBF, GBF, OR OTHER APPROVED MATERIAL. THE MATERIAL SHALL CONTAIN NO MORE THAN 10% PASSING THE NO. 200 (75 MM) SIEVE AND SHALL BE OTHERWISE SUITABLY GRADED. THE USE OF AN ESSENTIALLY ONE-SIZE MATERIAL WILL NOT BE PERMITTED UNLESS APPROVED.

17. ALL COMPACTED FILL MATERIAL SHALL BE SATISFACTORY BORROW SOILS APPROVED BY THE GEOTECHNICAL ENGINEER. REFER TO THE DETAILS FOR STONE TYPE AND DEPTH FOR THE SUBGRADE STONE FOR PAVEMENTS. ALL FILL MATERIAL SHALL BE FREE OF ORGANIC MATTER, FROZEN MATERIAL, LARGE ROCK GREATER THAN 3 INCHES, RUBBISH, SLAG, OR OTHER UNSUITABLE MATERIAL. SAMPLES OF THE FILL MATERIALS SHALL BE SUBMITTED TO THE GEOTECHNICAL ENGINEER FOR APPROVAL PRIOR TO PLACEMENT. ALL FILL EMBANKMENTS UNDER PAVED AREAS, SIDEWALKS, AND PADS SHALL BE PLACED IN LIFTS NOT TO EXCEED 8 INCHES IN LOOSE THICKNESS AND COMPACTED TO 100% OF MAXIMUM DRY DENSITY IN ACCORDANCE WITH ASTM DENSITY TEST D-1557. THE TOP 12 INCHES OF BUILDING SUBGRADE AND EACH 8 INCH LAYER OF BUILDING FILL EMBANKMENTS SHALL BE COMPACTED TO 100% MAXIMUM DRY DENSITY. THE AREA OF COMPACTED FILL FOR THE BUILDING SHALL EXTEND AT LEAST 5 FEET BEYOND THE EXTERIOR WALLS. FILL IN LAWN OR LANDSCAPE AREAS SHALL BE COMPACTED TO 93% MAXIMUM DRY DENSITY. FILL MATERIALS SHALL BE PLACED IN LIFTS NOT TO EXCEED 8 INCHES IN LOOSE THICKNESS AND SHOULD BE SPRINKLED WITH WATER AS REQUIRED TO ENSURE COMPACTION SPECIFICATIONS ARE MET. EXCESSIVELY WET MATERIAL SHALL BE SPREAD AND DRIED SUFFICIENTLY SO THAT THE MOISTURE CONTENT WILL PERMIT PROPER COMPACTION. EACH LAYER SHALL BE UNIFORMLY COMPACTED USING A VIBRATORY COMPACTOR OR OTHER APPROVED EQUIPMENT SUITED TO THE LOCATION AND MATERIAL BEING PLACED. UNDER NO CIRCUMSTANCES SHOULD A BULLDOZER OR SIMILAR TRACKED VEHICLES BE USED AS COMPACTING EQUIPMENT. LIFTS SHALL NOT EXCEED 4 INCHES IN LOOSE THICKNESS FOR MATERIAL COMPACTED BY HAND-OPERATED TAMPERS.

18. IN-PLACE DENSITY TESTS SHALL BE PERFORMED THROUGHOUT THE BUILDING FILL EMBANKMENTS. AT EACH COMPACTED FILL AND BACKFILL LAYER, AT LEAST ONE DENSITY TEST SHALL BE PERFORMED FOR EVERY 2000 SQ. FT OF BUILDING FILL OR SUBGRADE, BUT IN NO CASE FEWER THAN 3 TESTS. WHERE THE RESULTS OF THE IN-PLACE DENSITY TESTS INDICATE COMPACTION SPECIFICATIONS ARE NOT OBTAINED, OR WHERE APPROVED COMPACTED FILLS ARE DISTURBED BY THE CONTRACTOR'S SUBSEQUENT ACTIVITY OR ADVERSE WEATHER, THOSE AREAS SHALL BE REWORKED UNTIL COMPACTION CRITERIA ARE ACHIEVED. THE GEOTECHNICAL ENGINEER SHALL ISSUE A REPORT DOCUMENTING THE SUFFICIENCY OF THE FINAL COMPACTED FILL TO THE OWNER AND THE PROJECT ENGINEER.

19. IN AREAS WHERE THE PAVEMENT SUBGRADE ELEVATIONS ARE ACHIEVED WITHOUT FILL OPERATIONS, THESE AREAS SHALL BE PROOF-ROLLED WITH A MEDIUM WEIGHT ROLLER OR OTHER APPROVED EQUIPMENT TO DETERMINE IF ANY POCKETS OF SOFT, UNSUITABLE MATERIALS ARE PRESENT. IF POCKETS OF UNSUITABLE MATERIALS ARE ENCOUNTERED, THEY SHALL BE REMOVED AND REPLACED WITH SPOT SUBGRADE REINFORCEMENT OR COMPACTED GRANULAR FILL. THE GEOTECHNICAL ENGINEER OR A REPRESENTATIVE APPOINTED BY THE OWNER AND APPROVED BY THE ENGINEER SHALL BE PRESENT DURING PROOF-ROLLING OPERATIONS AND SHALL SUBMIT A REPORT OF ACCEPTANCE TO THE ENGINEER AND OWNER.

20. WHERE PREVIOUSLY APPROVED AND COMPACTED SUBGRADES ARE DISTURBED BY CONTRACTOR'S SUBSEQUENT ACTIVITY OR ADVERSE WEATHER, THE SUBGRADES SHALL BE SCARIFIED AND RECOMPACTED AS SPECIFIED ABOVE PRIOR TO THE CONTINUATION OF CONSTRUCTION.

21. EXCAVATE FOR STRUCTURES TO WITHIN 0.1 FOOT OF THE DESIGN ELEVATIONS AND DIMENSIONS. EXTEND EXCAVATIONS A SUFFICIENT DISTANCE FROM STRUCTURES FOR PLACING AND REMOVING CONCRETE FORMWORK. DO NOT DISTURB THE BOTTOM OF THE EXCAVATION INTENDED FOR BEARING SURFACE. EXCAVATE BY HAND TO FINAL GRADE BEFORE PLACING CONCRETE FORMWORK AND REINFORCEMENT SO FOOTINGS AND FOUNDATIONS BEAR ON UNDISTURBED COMPACTED SOILS.

22. BACKFILL MATERIAL SHALL BE FREE OF ORGANIC MATTER, FROZEN MATERIAL, LARGE ROCK GREATER THAN 2 INCHES, SLAG, RUBBISH, OR OTHER UNSUITABLE MATERIAL. BACKFILL SHALL BE PLACED IN LAYERS NOT TO EXCEED 6 INCHES LOOSE THICKNESS AND THOROUGHLY COMPACTED BY TAMPING OR ROLLING. WHERE BACKFILLING IS REQUIRED ON BOTH SIDES OF A FOUNDATION OR RETAINING WALL, THE BACKFILL MATERIAL SHALL BE PLACED EQUALLY ON BOTH SIDES TO AVOID UNBALANCED SOIL PRESSURE ON ONE SIDE OF THE WALL.

23. TRENCHING FOR ALL PIPE SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THESE PLANS WITH THE SIDES KEPT NEARLY AS VERTICAL AS POSSIBLE. LEDGE ROCK, BOULDERS, AND LARGE STONES SHALL BE REMOVED TO PROVIDE A MINIMUM CLEARANCE AS SHOWN ON THE BEDDING DETAILS IN THESE PLANS ON ALL SIDES OF ALL PIPES. ALL WATER ENTERING THE EXCAVATIONS OR OTHER PARTS OF THE WORK SHALL BE REMOVED UNTIL ALL THE WORK HAS BEEN COMPLETED. NO PIPE SHALL BE USED FOR THE DISPOSAL OF TRENCH WATER. EXCAVATIONS SHALL BE KEPT FREE FROM WATER UNTIL THE STRUCTURES TO BE BUILT THEREIN ARE COMPLETED AND WILL SAFELY WITHSTAND FORCES FROM SAID WATER. THE CONTRACTOR SHALL PROVIDE SUFFICIENT DEWATERING EQUIPMENT AND MAKE NECESSARY ARRANGEMENTS FOR THE DISPOSAL OF SAID WATER WITHOUT UNDUE INTERFERENCE WITH OTHER WORK OR DAMAGE TO PROPERTY.

24. TRENCHES UNDER PAVED AREAS (EXCLUDING SIDEWALKS) SHALL BE BACKFILLED WITH GRANULAR MATERIAL IN ACCORDANCE WITH SECTION 211 OF THE INDOT "STANDARD SPECIFICATIONS", LATEST EDITION, AND COMPACTED IN LIFTS. GRANULAR MATERIAL SHALL EXTEND 5 FT BEYOND THE LIMITS OF THE PAVED AREA WITH A 1:1 OUTWARD SLOPE TO THE BOTTOM OF THE TRENCH. WHEN THE TRENCH IS PARALLEL TO THE EDGE OF A PAVEMENT AREA, GRANULAR MATERIAL SHALL BE REQUIRED WITHIN 3 FEET FROM BACK OF CURB (TO THE LEADING EDGE OF THE TRENCH). GRANULAR BEDDING IS REQUIRED UNDER ALL PAVED AREAS.

25. TRENCHES OUTSIDE OF PAVED AREAS (EXCLUDING SIDEWALKS) SHALL BE BACKFILLED WITH SUITABLE MATERIAL, COMPACTED TO WITHIN SIX (6) INCHES OF THE FINISHED GROUND SURFACE; TOPSOIL SHALL BE USED TO BRING THE SURFACE TO FINISH GRADE. IF SPOIL MATERIAL IS ENCOUNTERED AND FOUND TO BE UNACCEPTABLE FOR BACKFILL, THEN GRANULAR MATERIAL SHALL BE USED.

26. BACKFILL AND BEDDING FOR FLEXIBLE PIPE CONDUIT MATERIALS SHALL BE GRANULAR MATERIAL IN ACCORDANCE WITH THE STANDARD BEDDING DETAILS CONTAINED HEREIN. BACKFILL FOR PIPES IN SHALLOW CONDITION (LESS THAN 2 FEET OF COVER) SHALL BE PLACED IN LIFTS NOT TO EXCEED 8 INCHES IN LOOSE THICKNESS AND COMPACTED TO 100% OF MAXIMUM DRY DENSITY IN ACCORDANCE WITH ASTM DENSITY TEST D-1557.

27. FOLLOWING THE COMPLETION OF SITE GRADING AND SUBSURFACE UTILITY INSTALLATION; CONTRACTOR SHALL SUPPLY AND INSTALL TOPSOIL FILL IN AREAS DESIGNATED FOR SEEDING, SODDING, OR LANDSCAPING, TO THE FINISH GRADES INDICATED ON THE GRADING PLAN AND TO A MINIMUM DEPTH OF 6 INCHES. THE FINISHED SURFACE SHALL BE UNIFORMLY AND SMOOTHLY GRADED AND SHALL BE FREE OF DEPRESSED AREAS WHERE WATER WILL POND. LIGHTLY COMPACT TOPSOIL AFTER PLACEMENT. THE FINISHED SURFACE GRADES SHALL NOT BE MORE THAN 0.1 FOOT ABOVE OR BELOW THE GRADES INDICATED ON THE PLANS. PROVIDE A SMOOTH TRANSITION BETWEEN EXISTING GRADES AND ADJACENT FILL.

EARTHWORK, SUBGRADE, TRENCHING, AND BUILDING PAD SPECIFICATIONS CONTINUED

28. NOTE: DUE TO THE LACK OF TOPSOIL PRESENT ONSITE, THE CONTRACTOR SHALL IMPORT TOPSOIL TO SPREAD IN ALL LANDSCAPED AND LAWN AREAS. CONTRACTOR WILL BACKFILL ALL GRASS AREAS WITH A MINIMUM OF 6-INCHES OF TOPSOIL. THIS AREA SHALL IMMEDIATELY BE SEEDED AND MULCHED, AND/OR LANDSCAPED, IF NECESSARY, UPON COMPLETION OF THE WATER, SANITARY AND STORM SEWER SYSTEMS WITH A SEED MIXTURE APPROPRIATE FOR THE TIME OF YEAR.

29. THE CONTRACTOR SHALL PLACE 6-INCHES MINIMUM OF TOPSOIL IN ALL DRAINAGE SWALES. THIS AREA SHALL BE IMMEDIATELY PERMANENTLY SEEDED AND LINED IN ACCORDANCE WITH THESE PLANS.

30. TOPSOIL FILL SHALL BE FREE OF BRICK, BLOCK, CONCRETE WASTE, ROCK, RUBBISH, OR OTHER UNSUITABLE MATERIAL AND SHALL BE MODERATELY COMPACTED WHEN PLACED TO AVOID EXCESSIVE SETTLEMENTS.

31. FURTHER SPECIFICATIONS REGARDING EARTHWORK AND THE CONTROL OF SEDIMENTATION MAY BE REQUIRED. SEE THE STORM WATER POLLUTION PREVENTION PLAN FOR FURTHER DETAILS.

STORM SEWER SYSTEM SPECIFICATIONS

1. CONSTRUCTION OF STORM DRAINS SHALL BE IN ACCORDANCE WITH THE LOCAL JURISDICTIONAL REQUIREMENTS, STANDARDS AND SPECIFICATIONS, AND SECTION 715 OF THE INDOT "STANDARD SPECIFICATIONS", LATEST EDITION AND DETAILS INCLUDED IN CONSTRUCTION DOCUMENTS.

2. THE CONTRACTOR SHALL NOTIFY THE LOCAL STORMWATER AUTHORITY AT LEAST 48 HOURS PRIOR TO ANY SEWER EXCAVATION OR CONSTRUCTION THAT IS WITHIN THE PUBLIC RIGHT-OF-WAY OR CONNECTS TO AN EXISTING PUBLIC FACILITY. SEWER PERMIT AND INSPECTION REQUIRED FOR ALL CONNECTIONS TO PUBLIC SEWER SYSTEM. SEWER PERMIT SHALL BE REQUIRED ON-SITE DURING ANY SEWER CONSTRUCTION, AS REQUIRED BY SAID REGULATIONS.

3. IN ACCORDANCE WITH 327 IAC 8-3.2-9; MAINTAIN A MINIMUM OF 10-FOOT HORIZONTAL SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF STORM SEWER, MAINTAIN A MINIMUM OF 8-FOOT SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF STORM MANHOLES, AND WHEN CROSSING WATER MAINS MAINTAIN A MINIMUM ANGLE OF 45° AND 18-INCHES VERTICAL SEPARATION.

4. ALL STORM DRAINS CROSSING WITHIN 18" VERTICALLY OF A SANITARY SEWER OR WATER MAIN SHALL HAVE A CONCRETE SPACER BLOCK POURED BETWEEN THE PIPES TO PROVIDE STRUCTURAL SUPPORT. WHEN CROSSING A WATER MAIN, A MINIMUM VERTICAL SEPARATION AT THE CROSSING LESS THAN 18 INCHES REQUIRES THAT THE SEWER (STORM OR SANITARY) MUST BE CONSTRUCTED OF PVC SDR 21 CONFORMING TO ASTM D-2241 OR APPROVED WATER MAIN MATERIAL HAVING A MINIMUM PRESSURE RATING OF 200 PSI, USING COMPRESSION FITTINGS, IN ACCORDANCE WITH 327 IAC 8-3.2-8 & 17A.

5. PRIMARY DRAINAGE SYSTEM SHALL BE CONSTRUCTED OF REINFORCED CONCRETE PIPE (RCP) CONFORMING TO ASTM C-76, HIGH DENSITY POLYETHYLENE (HDPE) ADS STORM XP DUAL WALL SINGLE MOLD HDPE PIPE WITH WATER TIGHT INTEGRAL BELL COUPLERS CONFORMING TO AASHTO M-294 AND ASTM F-667, OR POLYVINYLCHLORIDE (PVC) SDR-35 (SDR 26 WHEN INDICATED IN THE PLANS) CONFORMING TO ASTM D-3034 FOR PIPES 15 INCHES AND SMALLER. PVC RESIN COMPOUND SHALL CONFORM TO ASTM D-1784 AND RUBBER GASKETS TO ASTM D-3212 AND F-477. PIPE REACHES FOR JOINTS SHALL BE GASKETED BELL AND SPIGOT TYPE WITH THE BELL END MADE INTEGRAL WITH THE PIPE. PIPE MATERIAL SUBSTITUTIONS ACCEPTED BY THE ENGINEER MAY BE PERMITTED, BUT MUST BE FORMALLY REQUESTED BY CONTRACTOR IN WRITING AND APPROVED BY ENGINEER PRIOR TO INSTALLATION.

6. STORM DOWNSPOUT DRAIN LATERALS FOR BUILDING SUB-DRAIN AND DOWNSPOUT CONNECTIONS SHALL BE 6 IN DIAMETER PVC SDR-35 CONFORMING TO ASTM D-3034, LAID AT A MINIMUM SLOPE OF 0.5%. PIPE FITTINGS TEE- WYES, AND COUPLINGS SHALL BE SDR-26 MANUFACTURED FITTINGS MADE OF PVC PLASTIC HAVING A CELL CLASSIFICATION OF 12454-B OR 12454-C AS DEFINED IN ASTM U. 1784. SITE WORK CONTRACTOR SHALL COORDINATE WITH GUTTER/DOWNSPOUT CONTRACTOR FOR CONNECTIONS.

7. ALL MANHOLES AND INLET STRUCTURES SHALL BE PRECAST CONCRETE OR MONOLITHIC, CONSTRUCTED OF CLASS "A" 4,000 PSI CONCRETE, AND CONFORMING TO ASTM C-478.

8. NON-SHRINK GROUT SHALL BE USED ON ALL STORM DRAIN INLETS AND MANHOLES.

9. HOLES FOR PIPES IN PRECAST INLET BOXES MUST BE PRECAST OR SAWCUT. THE DIAMETER OF THE HOLE SHALL BE NO LARGER THAN FOUR INCHES GREATER THAN THE OUTSIDE DIAMETER OF THE PIPE THAT IS TO FIT INTO THE HOLE.

10. ADJUSTMENT OF CASTING TO BE ACCOMPLISHED WITH POUR IN PLACE MONOLITHIC CONCRETE TO A MAXIMUM DEPTH OF 4 INCHES. ANY CASTING ADJUSTMENT OVER 4 INCHES SHALL BE MADE WITH A PRECAST CONCRETE ADJUSTMENT RING.

11. MINIMUM FLANGE BEARING SURFACE SHALL BE 1-1/2" ON ALL SIDES OF THE INLET. CASTINGS SHALL REST FLUSH ON THE STRUCTURE. THE THICKNESS OF THE SIDES OF THE INLET BOXES TO BE A MINIMUM OF 6 INCHES.

12. CASTINGS SHALL BE SET IN MORTAR PER SECTION 720 OF THE INDOT "STANDARD SPECIFICATIONS", LATEST EDITION. ALL CASTINGS ARE TO BE COATED WITH BITUMASTIC PAINT.

13. PREMOLDED EXPANSION JOINTS ARE TO BE PROVIDED BETWEEN THE PAVEMENT AND THE DRAINAGE INLET CASTINGS LOCATED IN PAVED AREAS.

14. CONFIGURATION OF THE INLETS MAY BE VARIED TO ACCOMMODATE THE DIMENSIONS OF THE CASTINGS. PRIOR WRITTEN APPROVAL BY THE ENGINEER IS REQUIRED.

15. PIPES FOR STORM SEWERS ARE NOT TO ENTER OR EXIT RECTANGULAR PRECAST CONCRETE DRAINAGE BOXES AT THE CORNERS OF THE STRUCTURES. PIPE SHALL EITHER ENTER THROUGH ONE VERTICAL FACE, OR A CIRCULAR MANHOLE STRUCTURE SHALL BE EMPLOYED. PIPE TO BE CUT FLUSH WITH THE INSIDE OF THE STRUCTURE.

16. THE COMPLETED STORM SEWER SHALL BE HIGH PRESSURE WATER JET CLEANED AND TESTED IN ACCORDANCE WITH LOCAL REQUIREMENTS. ALL COSTS OF CLEANING AND TESTING ARE TO BE BORNE BY THE CONTRACTOR.

17. MAINLINE STORM SEWERS (MANHOLE TO MANHOLE) SHALL BE TELEVISED. LATERAL STORM SEWERS (MANHOLE TO INLET) IN EXCESS OF 40 FT. SHALL ALSO BE TELEVISED. MAINLINE STORM SEWERS THAT ARE 36" DIAMETER OR LESS SHALL BE SUBJECTED TO A MANDREL DEFLECTION TEST, WHEN CONSTRUCTED USING FLEXIBLE PIPE CONDUIT MATERIALS. MANDREL TESTING SHALL BE PERFORMED USING A NINE POINT "GO-NO-GO" MANDREL HAVING A DIAMETER NOT LESS THAN 95% OF THE PIPE DIAMETER; MANDREL SHALL BE MANUALLY PULLED, WITHOUT THE USE OF MECHANICAL DEVISES. CLEANING, TESTING AND TELEVISING SHALL BE PERFORMED A MINIMUM OF 45 DAYS AFTER INSTALLATION, ANY DEFICIENCIES SHALL BE REPAIRED, AND THE REWORKED SECTION SHALL BE RE-TESTED 30 DAYS AFTER COMPLETED REPAIRS AND BACKFILLING. CLEANING, TESTING AND TELEVISING SHALL BE WITNESSED BY THE LOCAL STORMWATER AUTHORITY. ALL COSTS OF CLEANING, TESTING AND TELEVISING ARE TO BE BORNE BY THE CONTRACTOR.

18. PIPE LENGTHS SHOWN ON THE DRAWINGS ARE FOR HYDRAULIC CALCULATION PURPOSES ONLY. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING EXACT PIPE LENGTHS REQUIRED FOR INSTALLATION.

△1 WATER SYSTEM SPECIFICATIONS

1. ALL WATER LINES SHALL BE CONSTRUCTED IN ACCORDANCE THE LOCAL JURISDICTIONAL REQUIREMENTS, STANDARDS AND SPECIFICATIONS, AND SHALL MEET THE MINIMUM REQUIREMENTS OF THE INDIANA STATE BOARD OF HEALTH, THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (IDEM) FOR DRINKING WATER SYSTEMS, AND SHALL MEET ALL APPLICABLE REQUIREMENTS OF INDIANA ADMINISTRATIVE CODE, TITLE 327, ARTICLE 8.

2. THE CONTRACTOR SHALL NOTIFY THE LOCAL WATER AUTHORITY AT LEAST 24 HOURS PRIOR TO START OF CONSTRUCTION TO MAKE ARRANGEMENTS FOR INSPECTION, TAPS AND SHUT DOWN OF EXISTING WATER MAINS WHERE REQUIRED.

3. NO UTILITY CONSTRUCTION SHALL COMMENCE UNTIL SUFFICIENT EARTHWORK HAS BEEN COMPLETED TO MEET THE MINIMUM COVER REQUIREMENTS CONTAINED IN THESE PLANS FOR ALL UTILITIES.

4. WATER SERVICE LINES SHALL HAVE A MINIMUM OF 60" OF COVER OVER THE TOP OF THE PIPE. IN ACCORDANCE WITH 327 IAC 8-3.2-9; MAINTAIN A MINIMUM OF 10-FOOT HORIZONTAL SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF SEWERS (STORM AND SANITARY), MAINTAIN A MINIMUM OF 8-FOOT SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF MANHOLES (STORM AND SANITARY) AND WHEN CROSSING SEWERS (STORM AND SANITARY) MAINTAIN A MINIMUM OF 18-INCHES VERTICAL SEPARATION.

5. WATER MAINS CROSSING ANY AND ALL SEWERS SHALL HAVE A MINIMUM VERTICAL SEPARATION OF 18" BETWEEN THE OUTSIDE OF THE WATER MAIN PIPE AND THE SEWER PIPE. ONE FULL LENGTH OF WATER MAIN PIPE SHALL BE CENTERED AT THE POINT OF THE CROSSING SUCH THAT BOTH JOINTS WILL BE EQUIDISTANT AND AS FAR AWAY FROM THE SEWER AS POSSIBLE. A MINIMUM VERTICAL SEPARATION AT THE CROSSING LESS THAN 18 INCHES REQUIRES THAT THE SEWER (STORM OR SANITARY) MUST BE CONSTRUCTED FROM WATER MAIN MATERIAL HAVING A MINIMUM PRESSURE RATING OF 200 PSI AND USING COMPRESSION FITTINGS, IN ACCORDANCE WITH 327 IAC 8-3.2-8 & 17A. TO ACCOMMODATE THE PIPES CALLED FOR.

6. ALL WATERMAINS SHALL BE CONSTRUCTED CONFORMING TO AWWA C-110. C-111, C-150 AND C-151 AS APPLICABLE.

7. THE CONTRACTOR SHALL FURNISH, INSTALL AND TEST ALL GATE VALVES. VALVES SHALL BE INSTALLED WITH VALVE BOX ALIGNERS (POSI-CAPS) AND MUST BE CENTERED PRIOR TO ACCEPTANCE. VALVE OPENING DIRECTION SHALL BE LEFT-HAND OPEN / COUNTER-CLOCKWISE.

8. ALL TEES, PLUGS, DEAD-ENDS, AND BENDS EXCEEDING 11.25⅛ SHALL BE MECHANICALLY RESTRAINED.

9. THE COMPLETED WATER SERVICE LINE SHALL BE TESTED AND DISINFECTED IN ACCORDANCE WITH LOCAL WATER AUTHORITY REQUIREMENTS AND AWWA C-651-92. TEST RESULTS ARE TO BE SENT TO THE LOCAL WATER AUTHORITY ENGINEER'S OFFICE WITHIN 5 DAYS OF TESTING.

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No. 19700312

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Performed for:

Site Specifications:
goshen public library
Parking & MEP Renovations
601 South 5th Street, Goshen, Indiana 46526

Drawing Revisions
△1 Addendum 1 - 07-24-2024

Commission Number
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Date
June 26th, 2024

Title
Site Specifications

Sheet Number
C0.1

PERMIT REVIEW SET - NOT FOR CONSTRUCTION

SANITARY SEWER SYSTEM SPECIFICATIONS

1. ALL SANITARY SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LOCAL JURISDICTIONAL REQUIREMENTS, STANDARDS, AND SPECIFICATIONS; SHALL MEET THE REQUIREMENTS OF THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (IDEM) FOR SANITARY SEWER COLLECTION SYSTEMS; AND SHALL MEET ALL APPLICABLE REQUIREMENTS OF INDIANA ADMINISTRATIVE CODE, TITLE 327, ARTICLE 3.

2. IN ACCORDANCE WITH 327 IAC 3-6-9; MAINTAIN A MINIMUM OF 10-FOOT HORIZONTAL SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF SANITARY SEWER, MAINTAIN A MINIMUM OF 8-FOOT SEPARATION BETWEEN OUTSIDE OF WATERMAIN AND OUTSIDE OF SANITARY MANHOLES, AND WHEN CROSSING WATER MAINS MAINTAIN A MINIMUM ANGLE OF 45⅛ AND 18-INCHES VERTICAL SEPARATION.

3. ALL SANITARY CROSSING WITHIN 18" VERTICALLY OF A STORM DRAIN OR WATER MAIN SHALL HAVE A CONCRETE SPACER BLOCK POURED BETWEEN THE PIPES, TO PROVIDE STRUCTURAL SUPPORT. WHEN CROSSING A WATER MAIN, A MINIMUM VERTICAL SEPARATION AT THE CROSSING LESS THAN 18 INCHES REQUIRES THAT THE SEWER (STORM OR SANITARY) MUST BE CONSTRUCTED OF PVC SDR 21 CONFORMING TO ASTM D-2241 OR APPROVED WATER MAIN MATERIAL HAVING A MINIMUM PRESSURE RATING OF 200 PSI, USING COMPRESSION FITTINGS, IN ACCORDANCE WITH 327 IAC 8-3.2-8 & 17A.

4. THE CONTRACTOR SHALL NOTIFY THE LOCAL SANITARY SEWER AUTHORITY AT LEAST 48 HOURS PRIOR TO ANY SEWER EXCAVATION OR CONSTRUCTION THAT IS WITHIN THE PUBLIC RIGHT-OF-WAY OR CONNECTS TO AN EXISTING PUBLIC FACILITY. SEWER TAP PERMIT AND LOCAL SANITARY SEWER AUTHORITY INSPECTION ARE REQUIRED FOR ALL CONNECTIONS TO EXISTING SANITARY SEWER SYSTEMS. SEWER PERMIT REQUIRED ON SITE DURING SEWER CONSTRUCTION. SEWER PERMIT SHALL BE REQUIRED ON-SITE DURING ANY SEWER CONSTRUCTION, AS REQUIRED BY SAID REGULATIONS.

5. ADDITIONS, DELETIONS, AND/OR REVISIONS TO THE SANITARY SEWER FACILITIES SHALL NOT BE MADE WITHOUT APPROVAL BY THE LOCAL SANITARY SEWER AUTHORITY.

6. ROOF DRAINS, FOUNDATION DRAINS, AND OTHER CLEAN WATER CONNECTIONS TO THE SANITARY SEWER SYSTEM ARE PROHIBITED.

7. SANITARY MANHOLES SHALL BE PRECAST CONCRETE OR MONOLITHIC, CONSTRUCTED OF CLASS "A" 4,000 PSI CONCRETE, AND CONFORMING TO ASTM C-478.

8. JOINTS BETWEEN PRECAST SANITARY MANHOLE SECTIONS SHALL CONFORM TO ASTM C-443.

9. SANITARY SEWER PIPE AND FITTINGS MAY BE EITHER POLYVINYL CHLORIDE PIPE (PVC) THAT CONFORMS TO ASTM D-3034, SDR 35 (SDR 26 FOR SANITARY SEWERS WITH AN EXCESS OF 15 FEET OF COVER OR WHEN INDICATED IN THE PLANS) WITH A MINIMUM CELL CLASSIFICATION OF 12454-C CONFORMING TO ASTM-3350 AND ASTM-F714, CELL CLASS P.E. 3344 33C, OR REINFORCED CONCRETE PIPE (RCP) CLASS III, IV, OR V IN ACCORDANCE WITH ASTM C-76, OR DUCTILE IRON PIPE (DI) CONFORMING TO ANSI SPECIFICATIONS A21.51 AND AWWA C-151.

10. THE MINIMUM WALL THICKNESS OF PVC PIPE SHALL CONFORM TO SDR-35, TYPE PSM, AS SPECIFIED IN ASTM D-3034. PVC AND HDPE PIPE SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 POUNDS PER SQUARE INCH FOR EACH DIAMETER WHEN MEASURED AT FIVE PERCENT DEFLECTION AND TESTED IN ACCORDANCE WITH ASTM D-2412.

11. PIPE JOINTS SHALL HAVE A BELL WALL, GASKET GROOVE, AND SPIGOT WHICH IS INTEGRAL WITH THE PIPE. THE ASSEMBLY OF JOINTS SHALL BE IN ACCORDANCE WITH THE PIPE MANUFACTURER'S RECOMMENDATIONS AND ASTM D-3212. SOLVENT CEMENT JOINTS SHALL NOT BE ALLOWED FOR MAINLINE PIPE.

12. PIPE FITTINGS SHALL BE SDR-26 MANUFACTURED FITTINGS MADE OF PVC PLASTIC HAVING A CELL CLASSIFICATION OF 12454-B OR 12454-C AS DEFINED IN ASTM U. 1784. SADDLE CONNECTIONS SHALL NOT BE ALLOWED FOR NEW CONSTRUCTION. LATERAL CONNECTIONS SHALL OCCUR AT SDR-26 TEE-WYES.

13. SANITARY SEWER LATERALS FOR BUILDING CONNECTIONS SHALL BE 6 IN DIAMETER PVC SDR-35 CONFORMING TO ASTM D-3034, LAID AT A MINIMUM SLOPE OF 1.08%. PIPE LATERALS LONGER THAN 100 FT REQUIRE A CLEAN-OUT STRUCTURE. LATERAL CONNECTIONS TO AN EXISTING SEWER SHALL BE MADE USING A BOOT-N-SADDLE TYPE CONNECTOR WITH STAINLESS STEEL STRAPS AND APPROPRIATE RUBBER FITTINGS.

14. ALL MANHOLE AND CLEAN-OUT CASTINGS SHALL HAVE THE WORDS "SANITARY SEWER" CAST IN THE LID.

15. THE COMPLETED SANITARY SEWER SHALL BE HIGH PRESSURE WATER JET CLEANED AND TESTED IN ACCORDANCE WITH LOCAL AND IDEM REQUIREMENTS. ALL COSTS OF CLEANING AND TESTING ARE TO BE BORNE BY THE CONTRACTOR.

16. MAINLINE SANITARY SEWERS SHALL BE SUBJECTED TO AN AIR TEST CONFORMING TO ASTM F1417-92 AND TELEVISED. MAINLINE SANITARY SEWERS SHALL BE SUBJECTED TO A MANDREL DEFLECTION TEST WHEN CONSTRUCTED USING FLEXIBLE PIPE CONDUIT MATERIALS. MANDREL TESTING SHALL BE PERFORMED USING A NINE POINT "GO-NO-GO" MANDREL HAVING A DIAMETER NOT LESS THAN 95% OF THE PIPE DIAMETER; MANDREL SHALL BE MANUALLY PULLED, WITHOUT THE USE OF MECHANICAL DEVISES. CLEANING, TESTING AND TELEVISING SHALL BE PERFORMED A MINIMUM OF 45 DAYS AFTER INSTALLATION, ANY DEFICIENCIES SHALL BE REPAIRED AND THE REWORKED SECTION SHALL BE RE-TESTED 30 DAYS AFTER COMPLETED REPAIRS. CLEANING, TESTING AND TELEVISING SHALL BE WITNESSED BY THE LOCAL SEWER AUTHORITY. ALL COSTS OF CLEANING, TESTING AND TELEVISING ARE TO BE BORNE BY THE CONTRACTOR.

17. DEWATERING OF THE SANITARY SEWER AS REQUIRED FOR CONSTRUCTION OR TESTING SHALL BE APPROVED BY THE LOCAL SANITARY SEWER AUTHORITY AND SHALL BE IN ACCORDANCE 327 IAC 3-6-20.

18. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION AND THE PIPE INVERT DEPTH WHERE THE PROPOSED CONNECTION IS MADE TO THE EXISTING SANITARY SEWER. VERTICAL DEVIATIONS GREATER THAN 0.1 FT. AND HORIZONTAL DEVIATIONS GREATER THAN 1.0 FT. SHALL BE REPORTED TO THE ENGINEER BEFORE PROCEEDING WITH CONSTRUCTION AT THAT LOCATION.

19. PIPE LENGTHS SHOWN ON THE DRAWINGS ARE FOR HYDRAULIC CALCULATION PURPOSES ONLY. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING EXACT PIPE LENGTHS REQUIRED FOR INSTALLATION.

CAST - IN - PLACE CONCRETE

1. THIS SECTION SPECIFIES CAST-IN PLACE CONCRETE, INCLUDING FORMWORK, REINFORCEMENT, CONCRETE MATERIALS, MIXTURE DESIGN, PLACEMENT PROCEDURES, AND FINISHES.

2. DESIGN MIXTURES FOR EACH CONCRETE MIXTURE INDICATE THE FOLLOWING:

   a. AREA(S) IN THE PROJECT WHERE MIX WILL BE USED
   b. COMPLETED MIX CONSTITUENT LIST BY WEIGHT
   c. SPECIFIC CEMENTITIOUS CONSTITUENTS BY WEIGHT
   d. WATER CEMENT RATIO
   e. SLUMP PRIOR TO ADDITION OF WATER REDUCING ADMIXTURES
   f. ADMIXTURE IDENTIFICATION WITH PRODUCT SHEETS
   g. AGGREGATE GRADATION BY SIEVE SIZE
   h. AMOUNT OF FINE AGGREGATE TO COARSE AGGREGATE RATIO
   i. TEST DATA SUBSTANTIATING DESIGN STRENGTH PER ACI-301 METHOD 1 OR 2. TEST DATA SUBMITTED MUST BE LESS THAN 2 YEARS OLD.
   j. INDICATE AMOUNTS OF MIXING WATER TO BE WITHHELD FOR LATER ADDITIONS AT PROJECT SITE.
   k. SHOP DRAWINGS FOR STEEL REINFORCEMENT.
   l. MATERIAL TEST REPORTS AND CERTIFICATIONS.

3. MANUFACTURER QUALIFICATIONS: A FIRM EXPERIENCED IN MANUFACTURING READY- MIXED CONCRETE PRODUCTS AND THAT COMPLIES WITH ASTM C94 REQUIREMENTS FOR PRODUCTION FACILITIES AND EQUIPMENT.

4. MANUFACTURER CERTIFIED ACCORDING TO NRMCA'S ©CERTIFICATION OF

5. FORMS FOR EXPOSED FINISH CONCRETE: PLYWOOD, METAL, METAL FRAMED PLYWOOD FACED, OR OTHER ACCEPTABLE PANEL - TYPE MATERIALS, TO PROVIDE CONTINUOUS, STRAIGHT, SMOOTH, EXPOSED SURFACES. FURNISH IN LARGEST PRACTICABLE SIZES TO MINIMIZE NUMBER OF JOINTS AND TO CONFORM TO JOINT SYSTEM SHOWN ON DRAWINGS.

6. FORMS FOR UNEXPOSED FINISH CONCRETE: PLYWOOD, LUMBER, METAL, OR OTHER ACCEPTABLE MATERIAL. PROVIDE LUMBER DRESSED ON AT LEAST 2 EDGES AND ON SIDE FOR TIGHT FIT.

7. FORM COATINGS: PROVIDE WATER BASED COMMERCIAL FORMULATION FORM- COATING COMPOUNDS THAT WILL NOT BOND WITH, STAIN, NOR ADVERSELY AFFECT CONCRETE SURFACES, AND WILL NOT IMPAIR SUBSEQUENT TREATMENTS OF CONCRETE SURFACES.

8. MANUFACTURER: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS OF THE FOLLOWING: A) DEBOND: L & M CONSTRUCTION CHEMICALS, INC.; B) RELEASE #1: THE BURKE CO.; C) OR APPROVED EQUAL.

9. FORM TIES: FACTORY-FABRICATED, ADJUSTABLE-LENGTH, REMOVABLE OR SNAP OFF METAL FORM TIES, DESIGNED TO PREVENT FORM DEFLECTION AND TO PREVENT SPALLING CONCRETE UPON REMOVAL. PROVIDE PLASTIC CONE OR BUTTON TYPE UNITS WHICH WILL LEAVE NO METAL CLOSER THAN 1 ½△ TO SURFACE. PROVIDE TIES WHICH, WHEN REMOVED, WILL LEAVE HOLES NOT LARGER THAN 1△ DIAMETER IN CONCRETE SURFACE.

10. STEEL REINFORCEMENT
   a. REINFORCING BARS: ASTM A 615 - GRADE 60, DEFORMED
   b. PLAIN-STEEL WELDED WIRE REINFORCEMENT: ASTM A 185 - PLAIN, FABRICATED FORM AS-DRAWN STEEL WIRE INTO FLAT SHEETS.
   c. DEFORMED-STEEL WELDED WIRE REINFORCEMENT ASTM A 497 - FLAT SHEET.
   d. BAR SUPPORTS: BOLSTERS, CHAIRS, SPACERS, AND OTHER DEVICES FOR SPACING, SUPPORTING, AND FASTENING REINFORCING BARS AND WELDED WIRE REINFORCEMENT IN PLACE. MANUFACTURE BAR SUPPORTS FROM STEEL WIRE, PLASTIC, OR PRECAST CONCRETE ACCORDING TO CRSI'S MANUAL OF STANDARD PRACTICE.
   e. FOR SLABS-ON-GRADE, USE SUPPORTS WITH SAND PLATES OR HORIZONTAL RUNNERS WHERE BASE MATERIAL WILL NOT SUPPORT CHAIR LEGS. CONCRETE BRICK MAY BE USED.
   f. FOR EXPOSED-TO-VIEW CONCRETE SURFACES, WHERE LEGS OF SUPPORTS ARE IN CONTACT WITH FORMS, PROVIDE SUPPORTS WITH LEGS WHICH ARE PLASTIC PROTECTED (CRSI, CLASS 1) OR STAINLESS STEEL PROTECTED (CRSI, CLASS 2).

CAST - IN - PLACE CONCRETE CONTINUED

11. CONCRETE MATERIALS
   a. CEMENTITIOUS MATERIAL: USE THE FOLLOWING CEMENTITIOUS MATERIALS, OF THE SAME TYPE, BRAND AND SOURCE THROUGHOUT THE PROJECT.
   b. PORTLAND CEMENT- ASTM C150, TYPE I SUPPLEMENT WITH THE FOLLOWING: FLYASH - ASTM C618, CLASS F
   c. NORMAL-WEIGHT AGGREGATES - ASTM C33, GRADED SEE MIX DESIGN SECTION FOR MAXIMUM AGGREGATE SIZES.
   d. FINE AGGREGATE - FREE OF MATERIALS WITH DELETERIOUS REACTIVITY TO ALKALI IN CEMENT.
   e. WATER - ASTM C94 AND POTABLE.
   f. ADMIXTURES:
   i. GENERAL - PROVIDE ADMIXTURES THAT CONTAIN NOT MORE THAN 0.15 PERCENT CHLORIDE IONS, AND NO CALCIUM CHLORIDE THYOCYANATES.
   ii. AIR ENTRAINMENT ADMIXTURE- ASTM C260
   iii. WATER-REDUCING ADMIXTURE - ASTM C94 TYPE A
   iv. HIGH-RANGE WATER-REDUCING ADMIXTURE (SUPERPLASTICIZER) - ASTM C494 TYPE F OR TYPE G
   v. WATER-REDUCING, NON-CORROSIVE, NON-CHLORIDE ACCELERATOR ADMIXTURE ASTM C494 TYPE C OR E, AND NOT CONTAINING MORE CHLORIDE IONS THAN ARE PRESENT IN MUNICIPAL DRINKING WATER. THE ADMIXTURE MANUFACTURE MUST HAVE LONG-TERM NON- CORROSIVE TEST DATA FROM AN INDEPENDENT TESTING LABORATORY (OF AT LEAST A YEAR'S DURATION) USING AN ACCEPTABLE ACCELERATED CORROSION TEST METHOD SUCH AS THOSE USING ELECTRICAL POTENTIAL MEASURES.
   vi. WATER-REDUCING, RETARDING ADMIXTURE - ASTM C494 TYPE D.

12. VAPOR RETARDERS: PLASTIC VAPOR RETARDER - ASTM E 1745 CLASS C - NOT LESS THAN 10 MILS THICK. INCLUDE MANUFACTURER'S RECOMMENDED ADHESIVE OR PRESSURE- SENSITIVE JOINT TAPE.

13. CURING MATERIALS
   a. EVAPORATION RETARDER - WATERBORNE, MONOMOLECULAR FILM FORMING, MANUFACTURED FOR APPLICATION TO FRESH CONCRETE.
   b. ABSORPTIVE COVER - AASHTO M 182 CLASS 2 - BURLAP CLOTH MADE FROM JUTE OR KENAF, WEIGHING APPROXIMATELY 9 OZ. / SQ.YD. WHEN DRY.
   c. MOISTURE-RETAINING COVER - ASTM C171 - POLYETHYLENE FILM OR WHITE BURLAP-POLYETHYLENE SHEET.
   d. WATER - POTABLE
   e. CLEAR, WATERBORNE, MEMBRANE-FORMING CURING COMPOUND - ASTM C309 TYPE I CLASS B DISSIPATING.
   f. SILENCURE - ASTM C309 TYPE I, ID & II - CLASS A & B - ACRYLIC CURING & SEALING COMPOUND CONTAINING SILANE

14. CONCRETE MIXTURES: PREPARE DESIGN MIXTURES FOR EACH TYPE OF STRENGTH OF CONCRETE, PROPORTIONED ON THE BASIS OF LABORATORY TRIAL MIXTURE OR FIELD TEST DATA, OR BOTH, ACCORDING TO ACI 301.
   a. PROPORTION NORMAL-WEIGHT CONCRETE MIXTURE AS FOLLOWS: PREPARE DESIGN MIXES FOR EACH TYPE AND STRENGTH OF CONCRETE BY EITHER LABORATORY TRIAL BATCH OR FIELD EXPERIENCE METHODS AS SPECIFIED IN ACI 301. IF TRIAL BATCH METHOD USED, USE AN INDEPENDENT TESTING FACILITY ACCEPTABLE TO ARCHITECT/ENGINEER FOR PREPARING AND REPORTING PROPOSED MIX DESIGNS. THE TESTING FACILITY SHALL NOT BE THE SAME AS USED FOR FIELD QUALITY CONTROL TESTING.
   b. SUBMIT WRITTEN REPORTS TO ARCHITECT/ENGINEER AND STRUCTURAL ENGINEER OF EACH PROPOSED MIX FOR EACH CLASS OF CONCRETE AT LEAST 15 DAYS PRIOR TO START OF WORK. DO NOT BEGIN CONCRETE PRODUCTION UNTIL ARCHITECT/ENGINEER HAS REVIEWED MIXES.

15. DESIGN MIXES: PROVIDE NORMAL WEIGHT CONCRETE WITH THE FOLLOWING PROPERTIES, AS INDICATED ON DRAWINGS.

	CLASS A6 BAG A/E STONE	CLASS C7 BAG A/E STONE
COARSE AGG. TYPE	CLASS A#8 OR #5 STONE	CLASS A#8 OR #5 STONE
FNE AGG. TYPE	#23 SAND	#23 SAND
FINE AGG. TO COARSE AGG. RATIO	35–45 %	35–45 %
TYPE 1 CEMENT	564	658
MAX. FLYASH REPLACEMENT *	15 %	15 %
WATER TO CEMENT RATIO	0.45	0.40
SLUMP MAX	5"	5"
MAX. SLUMP WITH MID RANGE WATER REDUCER	6"	6"
MAX. SLUMP WITH HIGH RANGE WATER REDUCER	7"	7"
AIR ENTRAINMENT	6.5 +/– 1.5%	6.5 +/– 1.5%

NOTES:
i. ASTM C33 DESIGNATIONS.
ii. PROVIDE COARSE AGGREGATE #5 AGGREGATE TOP SIZE 1 ½△ AND #8 AGGREGATE <1△ TOP SIZE.
iii. THE USE OF FLYASH IS PERMITTED BETWEEN THE MONTHS OF APRIL 15TH TO OCTOBER 15TH. TYPE C FLYASH OR C/F SHALL BE USED.

16. ADMIXTURE: USE MID RANGE WATER-REDUCER OR HIGH RANGE WATER-REDUCER ADMIXTURE IN CONCRETE AS REQUIRED FOR PLACEMENT AND WORKABILITY.
   a. USE NON-CHLORIDE ACCELERATING ADMIXTURE IN CONCRETE PLACED IN AMBIENT TEMPERATURES BELOW 50 DEGREES F.
   b. USE AIR-ENTRAINMENT ADMIXTURE IN EXTERIOR EXPOSED CONCRETE, UNLESS OTHERWISE INDICATED. ADD AIR-ENTRAINMENT ADMIXTURE AT MANUFACTURER'S PRESCRIBED RATE TO RESULT IN CONCRETE AT POINT OF PLACEMENT HAVING TOTAL AIR CONTENT WITH IN THE TOLERANCE OF PLUS OR MINUS 1 ½ PERCENT. OTHER CONCRETE NOT EXPOSED TO FREEZING, THAWING, OR HYDRAULIC PRESSURE 2 PERCENT TO 4 PERCENT AIR.
   c. SLUMP LIMITS - PROPORTION AND DESIGN MIXES TO RESULT IN CONCRETE SLUMP AT POINT OF PLACEMENT AS FOLLOWS: GENERAL 4△ +/- 1△; INTERIOR SLAB ON GRADE 5△ +/- 1△; CONCRETE CONTAINING MRWR ADMIXTURE (MIDRANGE) NOT MORE THAN 6△ AFTER MRWR IS ADDED; CONCRETE CONTAINING HRWR ADMIXTURE (SUPER-PLASTICIZER) NOT MORE THAN 7△ AFTER ADDITION OF HRWR.
   d. CEMENTITIOUS MATERIALS - LIMIT PERCENTAGE, BY WEIGHT, OF CEMENTITIOUS MATERIALS OTHER THAN PORTLAND CEMENT IN CONCRETE AS FOLLOWS: FLY ASH - 15 PERCENT MAX.

17. RELATED MATERIALS:
   a. EXPANSION AND ISOLATION JOINT FILLER STRIPS - ASTM D1751 -ASPHALT SATURATED CELLULOSIC FIBER;
   b. WATERSTOPS - PROVIDE TYPES AS NOTED ON PLAN FOR SPECIAL APPLICATIONS. PERFORMED, FLAT, DUMBBELL OR CENTER BULB TYPES AT CONSTRUCTION JOINTS AND OTHER JOINTS AS INDICATED. RUBBER WATERSTOPS - CORPS OF ENGINEERS CRD- C 513; POLYVINYL CHLORIDE WATERSTOPS - CORPS OF ENGINEERS CRD-C 572.
   c. NON-SHRINK GROUT - CRD-C 621 FACTORY PRE-MIXED GROUT. NON- METALLIC.
   d. BONDING COMPOUND - POLYVINYL ACETATE OR ACRYLIC BASE. PRODUCTS - SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
   i. POLYVINYL ACETATE (INTERIOR ONLY);
   i. EUCO WELD - EUCLID CHEMICAL CO.;
   ii. EVERWELD - L & M CONSTRUCTION CHEMICALS
   ii. ACRYLIC OR STYRENE BUTADIENE
   i. EVERBOND - L & M CONSTRUCTION CHEMICALS
   ii. SONOCRETE - SONNEBORN
   iii. ACRYLIC BONDCRETE - THE BURKE CO
   iv. SBR LATEX - EUCLID CHEMICAL CO.
   v. DARAWELD C - W R GRACE
   vi. ACRYL SET - MASTER BUILDERS
   vii. INTERLOK - W R GRACE
   iii. EPOXY ADHESIVE - ASTM C881 - TWO-COMPONENT MATERIAL SUITABLE FOR USE ON DRY OR DAMP SURFACES. PROVIDE MATERIAL TYPE, GRADE AND CLASS TO SUITE PROJECT REQUIREMENTS.

18. JOINTS:
   a. GENERAL: CONSTRUCT JOINTS TRUE TO LINE WITH FACES PERPENDICULAR TO SURFACE PLANE OF CONCRETE.
   b. CONSTRUCTION JOINTS: INSTALL SO STRENGTH AND APPEARANCE OF CONCRETE ARE NOT IMPAIRED, AT LOCATIONS INDICATED OR AS APPROVED BY ARCHITECT.
   c. CONTRACTION JOINTS IN SLAB-ON-GRADE: FORM WEAKENED-PLANE CONTRACTION JOINTS, SECTIONING CONCRETE INTO AREAS AS INDICATED. CONSTRUCT CONTRACTION JOINTS FOR A DEPTH EQUAL TO AT LEAST ONE-FOURTH OF CONCRETE THICKNESS AS FOLLOWS:
   i. SAWED JOINTS: FORM CONTRACTION JOINTS WITH POWER SAWS EQUIPPED WITH SHATTERPROOF ABRASIVE OR DIAMOND- RIMMED BLADES. CUT 1/8 INCH WIDE JOINTS INTO CONCRETE WHEN CUTTING ACTION WILL NOT TEAR, ABRADE, OR OTHERWISE DAMAGE SURFACE AND BEFORE CONCRETE DEVELOPS RANDOM CONTRACTION CRACKS.
   ii. ISOLATION JOINTS IN SLAB-ON-GRADE: AFTER REMOVING FORMWORK, INSTALL JOINT-FILLER STRIPS AT SLAB JUNCTIONS WITH VERTICAL SURFACES, SUCH AS COLUMN PEDESTALS, FOUNDATION WALLS, GRADE BEAMS, AND OTHER LOCATIONS, AS INDICATED.

CAST - IN - PLACE CONCRETE CONTINUED

19. CONCRETE PLACEMENT: BEFORE PLACING CONCRETE, VERIFY THAT INSTALLATION OF FORMWORK, REINFORCEMENT, AND EMBEDDED ITEMS IS COMPLETE AND THAT REQUIRED INSPECTIONS HAVE BEEN PERFORMED. DEPOSIT CONCRETE CONTINUOUSLY IN ONE LAYER OR IN HORIZONTAL LAYERS OF SUCH THICKNESS THAT NO NEW CONCRETE WILL BE PLACED ON CONCRETE THAT HAS HARDENED ENOUGH TO CAUSE SEAMS OR PLANES OF WEAKNESS. IF A SECTION CANNOT BE PLACED CONTINUOUSLY, PROVIDE CONSTRUCTION JOINTS AS INDICATED. DEPOSIT CONCRETE TO AVOID SEGREGATION. CONSOLIDATE PLACED CONCRETE WITH MECHANICAL VIBRATING EQUIPMENT ACCORDING TO ACI 301.
   a. COLD WEATHER PLACEMENT - COMPLY WITH ACI 306.1.
   b. HOT WEATHER PLACEMENT - COMPLY WITH ACI 301

20. SLAB FINISH TOLERANCE: LOCAL FLATNESS/LEVELNESS TOLERANCES: ALL FLOORS SHALL CONFORM TO THE FOLLOWING ACI F-NUMBER REQUIREMENTS: A) SPECIFIED OVERALL VALUE: FF-25/FL-20; B) MINIMUM LOCAL VALUE: FF-20/FL-15.
   a. AT CONSTRUCTION JOINTS IN ALL AREAS, A 10-FOOT STRAIGHT EDGE CENTERED ON THE CONSTRUCTION JOINT SHALL NOT HAVE A GAP OF MORE THAN 1/8 INCH AT CENTER (JOINT TOO LOW) OR EITHER END (JOINT TOO HIGH).
   b. GENERAL CONFORMITY TO DESIGN GRADE: THE FLOOR SHALL FALL WITHIN +/- ½ INCH OF THE FINISHED FLOOR ELEVATION SHOWN ON THE PLANS.
   c. FLOOR TOLERANCE MEASUREMENTS: FLOOR FLATNESS AND LEVELNESS TEST ON THE FLOOR SHALL BE CONDUCTED IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN ASTM E 1155-87. FLOOR TOLERANCE MEASUREMENTS SHALL BE MADE BY THE OWNER WITHIN 48 HOURS AFTER COMPLETION OF THE FINAL TROWELING OPERATION - AND IN ALL CASES BEFORE FORMS AND/OR SHORES HAVE BEEN REMOVED - USING A DIPSTICK FLOOR PROFILER AS MANUFACTURED BY THE EDWARD W FACE COMPANY, INC OR NORFOLK, VA. RESULTS OF ALL FLOOR TOLERANCE TESTS - INCLUDING A FORMAL NOTICE OF ACCEPTANCE OR REJECTION OF THE WORK - SHALL BE PROVIDED TO THE CONTRACTOR WITHIN 24 HOURS AFTER DATA COLLECTION.
   d. WEEKENDS AND HOLIDAYS SHALL BE IGNORED WHEN COMPUTING THE TESTING AND REPORTING DEADLINES SPECIFIED ABOVE.
   e. REMEDY FOR OUT-OF-TOLERANCE WORK: ALL FLOOR SECTIONS MEASURING AT OR ABOVE BOTH OF THE SPE3CIFIED MINIMUM LOCAL F-NUMBERS SHALL BE ACCEPTED FOR TOLERANCES COMPLIANCE AS CONSTRUCTED. ALL FLOOR SECTIONS MEASURING BELOW EITHER (OR BOTH) OF THE SPECIFIED MINIMUM LOCAL F-NUMBERS SHALL BE REMOVED AND REPLACED (IN THE CASE OF SLABS-ON-GRADE), OR GROUND AND/OR RE-TOPPED (IN THE CASE OF ELEVATED SLABS). NO REMEDIES FOR SUB-MINIMUM LOCAL F-NUMBER SECTIONS OTHER THAN REPLACEMENT OF SLABS-ON-GRADE, AND GRINDING OR RE-TOPPING OF ELEVATED SLABS WILL BE PERMITTED. FOR THE PURPOSES OF THIS PARAGRAPH, A FLOOR SECTION SHALL BE ANY RECTANGULAR AREA BOUND BY COLUMN AND/OR HALF-COLUMN LINES.

21. FINISHING FORMED SURFACES
   a. ROUGH-FORMED FINISH: AS-CAST CONCRETE TEXTURE IMPARTED BY FORM- FACING MATERIAL WITH TIE HOLES AND DEFECTS REPAIRED AND PATCHED. REMOVE FINS AND OTHER PROJECTIONS THAT EXCEED SPECIFIED LIMITS ON FORMED-SURFACE IRREGULARITIES. APPLY TO CONCRETE SURFACES NOT EXPOSED TO PUBLIC VIEW.
   b. SMOOTH-FORMED FINISH: AS-CAST CONCRETE TEXTURE IMPARTED BY FORM-FACING MATERIAL, ARRANGED IN AN ORDERLY AND SYMMETRICAL MANNER WITH A MINIMUM OF SEAMS. REPAIR AND PATCH TIE HOLES AND DEFECTS. REMOVE FINS AND OTHER PROJECTIONS THAT EXCEED SPECIFIED LIMITS ON FORMED-SURFACE IRREGULARITIES. APPLY TO CONCRETE SURFACES EXPOSED TO PUBLIC VIEW, TO RECEIVE A RUBBED FINISH, TO BE COVERED WITH A COATING OR COVERING MATERIAL APPLIED DIRECTLY TO CONCRETE.
   c. RUBBED FINISH: APPLY THE FOLLOWING TO SMOOTH-FORMED FINISHED AS- CAST CONCRETE WHERE INDICATED.
   i. SMOOTH-RUBBED FINISH: NO LATER THAN ONE DAY AFTER FORM REMOVAL, MOISTEN CONCRETE SURFACES AND RUB WITH CARBORUNDUM BRICK OR ANOTHER ABRASIVE UNTIL PRODUCING A UNIFORM COLOR AND TEXTURE. DO NOT APPLY CEMENT GROUT OTHER THAN THAT CREATED BY THE RUBBING PROCESS.
   ii. GROUT-CLEANED FINISHES: WET CONCRETE SURFACES AND APPLY GROUT OF A CONSISTENCY OF THICK PAINT TO COAT SURFACES AND FILL SMALL HOLES. MIX ONE PART PORTLAND CEMENT TO ONE AND ONE-HALF PARTS FINE SAND WITH A 1:1 MIXTURE OF BONDING ADMIXTURE AND WATER. ADD WHITE PORTLAND CEMENT IN AMOUNTS DETERMINED BY TRIAL PATCHES SO COLOR OF DRY GROUT WILL MATCH ADJACENT SURFACES. SCRUB GROUT INTO VOIDS AND REMOVE EXCESS GROUT. WHEN GROUT WHITENS, RUB SURFACE WITH CLEAN BURLAP AND KEEP SURFACE DAMP BY FOG SPRAY FOR AT LEAST 36 HOURS.
   d. RELATED UNFORMED SURFACES: AT TOPS OF WALLS, HORIZONTAL OFFSETS, AND SIMILAR UNFORMED SURFACES ADJACENT TO FORMED SURFACES, STRIKE OFF SMOOTH AND FINISH WITH A TEXTURE MATCHING ADJACENT FORMED SURFACES. CONTINUE FINAL SURFACE TREATMENT OF FORMED SURFACES UNIFORMLY ACROSS ADJACENT UNFORMED SURFACES, UNLESS OTHERWISE INDICATED.

22. FINISHING FLOORS AND SLABS: COMPLY WITH ACI 302.1R RECOMMENDATIONS FOR SCREEDING, RESTRAIGHTENING, AND FINISHING OPERATIONS FOR CONCRETE SURFACES. DO NOT WET CONCRETE SURFACES.
   a. SCRATCH FINISH: WHILE STILL PLASTIC, TEXTURE CONCRETE SURFACE THAT HAS BEEN SCREEDED AND BULL-FLOATED OR DARBIED. USE STIFF BRUSHES, BROOMS, OR RAKES TO PRODUCE A PROFILE AMPLITUDE OF ½ INCH IN 1 DIRECTION. APPLY SCRATCH FINISH TO SURFACES INDICATED AND TO RECEIVE CONCRETE FLOORING TOPPINGS OR TO RECEIVE MORTAR SETTING BEDS FOR BONDED CEMENTITIOUS FLOOR FINISHES.
   b. FLOAT FINISH: CONSOLIDATE SURFACE WITH POWER-DRIVEN FLOATS OR BY HAND FLOATING IF AREA IS SMALL OR INACCESSIBLE TO POWER DRIVEN FLOATS. RESTRAIGHTEN, CUT DOWN HIGH SPOTS, AND FILL LOW SPOTS. REPEAT FLOAT PASSES AND RESTRAIGHTENING UNTIL SURFACES IS LEFT WITH A UNIFORM, SMOOTH, GRANULAR TEXTURE. APPLY FLOAT FINISH TO SURFACES TO RECEIVE TROWEL FINISH AND TO BE COVERED WITH FLUID-APPLIED OR SHEET WATERPROOFING, BUILT-UP OR MEMBRANE ROOFING, OR SAND-BED TERRAZZO.
   c. TROWEL FINISH: AFTER APPLYING FLOAT FINISH, APPLY FIRST TROWELING AND CONSOLIDATE CONCRETE BY HAND OR POWER-DRIVEN TROWEL. CONTINUE TROWELING PASSES AND RESTRAIGHTEN UNTIL SURFACE IS FREE OF TROWEL MARKS AND UNIFORM IN TEXTURE AND APPEARANCE. GRIND SMOOTH ANY SURFACE DEFECTS THAT WOULD TELEGRAPH THROUGH APPLIED COATINGS OR FLOOR COVERINGS. APPLY A TROWEL FINISH TO SURFACES EXPOSED TO VIEW OR TO BE COVERED WITH RESILIENT FLOORING, CARPET, AND CERAMIC OR QUARRY TILE SET OVER A CLEAVAGE MEMBRANE, PAINT, OR ANOTHER THIN-FILM-FINISH COATING SYSTEM. FINISH AND MEASURE SURFACE SO GAP AT ANY POINT BETWEEN CONCRETE SURFACE AND AN UNLEVELED, FREESTANDING, 10-FOOT-LONG STRAIGHTEDGE RESTING ON 2 HIGH SPOTS AND PLACED ANYWHERE ON THE SURFACE DOES NOT EXCEED 3/16 INCH.
   d. TROWEL AND FINE-BROOM FINISH: APPLY A FIRST TROWEL FINISH TO SURFACES WHERE CERAMIC OR QUARRY TILE IS TO BE INSTALLED BY EITHER THICKSET OR THIN-SET METHOD. WHILE CONCRETE IS STILL PLASTIC, SLIGHTLY SCARIFY SURFACE WITH A FINE BROOM. COMPLY WITH FLATNESS AND LEVELNESS TOLERANCES FOR TROWEL FINISHED FLOOR SURFACES.
   e. BROOM FINISH: APPLY A BROOM FINISH TO EXTERIOR CONCRETE PLATFORMS, STEPS, AND RAMPS AND ELSEWHERE AS INDICATED.

23. CONCRETE PROTECTING AND CURING: PROTECT FRESHLY PLACED CONCRETE FROM PREMATURE DRYING AND EXCESSIVE COLD OR HOT TEMPERATURES. COMPLY WITH ACI 306.1 FOR COLD-WEATHER PROTECTION AND ACI 301 FOR HOT-WEATHER PROTECTION DURING CURING.
   a. EVAPORATION RETARDER: APPLY EVAPORATION RETARDER TO UNFORMED CONCRETE SURFACES IF HOT, DRY, OR WINDY CONDITIONS CAUSE MOISTURE LOSS APPROACHING 0.2 LBS/SQ.FT. X H BEFORE AND DURING FINISHING OPERATIONS. APPLY ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS AFTER PLACING, SCREEDING, AND BULL FLOATING OR DARBYING CONCRETE, BUT BEFORE FLOAT FINISHING.
   b. CURE CONCRETE ACCORDING TO ACI 308.1, BY ONE OR A COMBINATION OF THE FOLLOWING METHODS:
   i. MOIST CURING- KEEP SURFACES CONTINUOUSLY MOIST FOR NOT LESS THAN SEVEN DAYS;
   ii. MOISTURE-RETAINING-COVER CURING- COVER CONCRETE SURFACES WITH MOISTURE-RETAINING COVER FOR CURING CONCRETE, PLACED IN WIDEST PRACTICABLE WIDTH, WITH SIDES AND ENDS LAPPED AT LEAST 12 INCHES, AND SEALED BY WATERPROOF TAPE OR ADHESIVE. CURE FOR NOT LESS THAN SEVEN DAYS. IMMEDIATELY REPAIR ANY HOLES OR TEARS DURING CURING PERIOD USING COVER MATERIALS AND WATERPROOF TAPE.
   iii. CURING COMPOUND - APPLY UNIFORMLY IN CONTINUOUS OPERATION BY POWER SPRAY OR ROLLER ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. RECOAT AREAS SUBJECTED TO HEAVY RAINFALL WITHIN THREE HOURS AFTER INITIAL APPLICATION. MAINTAIN CONTINUITY OF COATING AND REPAIR DAMAGE DURING CURING PERIOD.
   i. AFTER CURING PERIOD HAD ELAPSED, REMOVE CURING COMPOUND WITHOUT DAMAGING CONCRETE SURFACES BY METHOD RECOMMENDED BY CURING COMPOUND MANUFACTURER UNLESS MANUFACTURER CERTIFIES CURING COMPOUND WILL NOT INTERFERE WITH BONDING OF FLOOR COVERING USED ON PROJECT.
   iv. CURING AND SEALING COMPOUND- APPLY UNIFORMLY TO FLOORS AND SLABS INDICATED IN A CONTINUOUS OPERATION BY POWER SPRAY OR ROLLER ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. RECOAT AREAS SUBJECTED TO HEAVY RAINFALL WITHIN THREE HOURS AFTER INITIAL APPLICATION. REPEAT PROCESS 24 HOURS LATER AND APPLY A SECOND COAT. MAINTAIN CONTINUITY OF COATING AND REPAIR DAMAGE DURING CURING PERIOD.

24. CONCRETE SURFACE REPAIRS: DEFECTIVE CONCRETE - REPAIR PATCH DEFECTIVE AREAS WHEN APPROVED BY ARCHITECT. REMOVE AND REPLACE CONCRETE THAT CANNOT BE REPAIRED AND PATCHED TO ARCHITECT'S APPROVAL.

CAST - IN - PLACE CONCRETE CONTINUED

25. QUALITY CONTROL TESTING DURING CONSTRUCTION
   a. EMPLOY A TESTING LABORATORY TO PERFORM TEST AND TO SUBMIT TEST REPORTS. THE INSPECTOR SHALL BE ACI CERTIFIED LEVEL 1.
   b. SAMPLING AND TESTING FOR QUALITY CONTROL DURING PLACEMENT OF CONCRETE MAY INCLUDE THE FOLLOWING, AS DIRECTED BY ARCHITECT/ENGINEER.
   i. SAMPLING FRESH CONCRETE ASTM C172, EXCEPT MODIFIED FOR SLUMP TO COMPLY WITH ASTM C94.
   i. SLUMP: ASTM C143; ONE TEST AT POINT OF DISCHARGE FOR EACH TIME TEST CYLINDERS ARE TAKEN. ADDITIONAL TESTS WHEN CONCRETE CONSISTENCY SEEMS TO HAVE CHANGED.
   ii. AIR CONTENT: ASTM C173, VOLUMETRIC METHOD FOR LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE; ASTM C231 PRESSURE METHOD FOR NORMAL WEIGHT CONCRETE; ONE FOR EACH TIME TEST CYLINDERS ARE TAKEN.
   iii. UNIT WEIGHT: ASTM C29 BULK DENSITY (UNIT WEIGHT).
   i. CONCRETE TEMPERATURE: TEST HOURLY WHEN AIR TEMPERATURE IS 40 DEGREE F AND BELOW, AND WHEN 80 DEGREE F AND ABOVE; AND EACH TIME A SET OF COMPRESSION TEST SPECIMENS ARE MADE.
   ii. COMPRESSION TEST SPECIMEN: ASTM C31, ONE SET OF 4 STANDARD CYLINDERS FOR EACH COMPRESSIVE STRENGTH TEST, UNLESS OTHERWISE DIRECTED. MOLD AND STORE CYLINDERS FOR LABORATORY CURED TEST SPECIMENS EXCEPT WHEN FIELD-CURE TEST SPECIMENS ARE REQUIRED.
   iii. COMPRESSIVE STRENGTH TEST: ASTM C39; ONE SET FOR EACH DAY'S POUR EXCEEDING 5 CU.YDS, PLUS ADDITIONAL SETS FOR EACH 50 CY.YD. OVER AND ABOVE THE FIRST 25 CU.YDS. OF EACH CONCRETE CLASS PLACED IN ANY ONE DAY; ONE SPECIMEN TESTED AT 7 DAYS, TWO SPECIMENS TESTED AT 28 DAYS, AND ONE RETAINED IN RESERVE FOR LATER TESTING IF REQUIRED.
   i. INTERIOR SLABS: ONE TEST SPECIMEN SET PER TWO BAYS OF FLOOR SLAB. NO LESS THAN ONE SET PER POUR.
   ii. WHEN FREQUENCY OF TESTING WILL PROVIDE LESS THAN 5 STRENGTH TESTS FOR A GIVEN CLASS OF CONCRETE, CONDUCT TESTING FROM AT LEAST 5 RANDOMLY SELECTED BATCHES FROM EACH BATCH IF FEWER THAN 5 ARE USED.
   iii. WHEN TOTAL QUANTITY OF A GIVEN CLASS OF CONCRETE IS LESS THAN 50 CU.YDS, STRENGTH TEST MAY BE WAIVED BY ARCHITECT/ENGINEER IF, IN HIS JUDGMENT, ADEQUATE EVIDENCE OF SATISFACTORY STRENGTH IS PROVIDED.
   iv. WHEN STRENGTH OF FIELD-CURED CYLINDERS IS LESS THAN 85 PERCENT OF COMPANION LABORATORY CURED CYLINDERS, EVALUATE CURRENT OPERATIONS AND PROVIDE CORRECTIVE PROCEDURES FOR PROTECTING AND CURING THE IN-PLACE CONCRETE.
   v. STRENGTH LEVEL OF CONCRETE WILL BE CONSIDERED SATISFACTORY IF AVERAGES OF SETS OF THREE CONSECUTIVE STRENGTH TEST RESULTS EQUAL OR EXCEED THE SPECIFIED COMPRESSIVE STRENGTH, AND NO INDIVIDUAL STRENGTH TEST RESULT FALLS BELOW SPECIFIED COMPRESSIVE STRENGTH BY MORE THAN 4000 PSI.
   ii. FLEXURAL STRENGTH OF CONCRETE: ASMT C78, THE FLEXURAL STRENGTH OF CONCRETE USED FOR CONCRETE SLAB-ON- GRADE SHALL BE ESTABLISHED PRIOR TO START OF CONCRETE PLACEMENT OPERATIONS.
   i. ONE TEST SPECIMEN SET PER FOR BAYS OF FLOOR SLAB. NO LESS THAN ONE SET PER POUR. FOUR BEAMS PER SPECIMEN SET MOLD AND STORE FOR LAB CURING. TEST ONE AT 28 DAYS, TWO AT 56 DAYS, AND ONE SPARE.
   ii. STRENGTH LEVEL OF CONCRETE WILL BE CONSIDERED SATISFACTORY IF AVERAGES OF SETS OF THREE CONSECUTIVE STRENGTH TEST RESULTS EQUAL OR EXCEED THE SPECIFIED FLEXURAL STRENGTH, AND NO INDIVIDUAL STRENGTH TEST RESULT FALLS BELOW SPECIFIED FLEXURAL STRENGTH BY MORE THAN 50 PSI.
   iii. CONCRETE FLOOR FLATNESS AND LEVELNESS
   i. TWO (2) DEVICES ARE USED TO RUN TEST. TYPE I DEVICE - DIPSTICK AND TYPE II DEVICE - WHEEL. MAKE SURE THAT THE DEVICE BEING USED HAS BEEN RECENTLY CALIBRATED WITHIN THREE MONTHS. OWING TO THE MATHEMATICS INVOLVED IN F-NUMBERS, INSTRUMENT INACCURACIES WILL ALWAYS RESULT IN A LOWERING OF REPORTED F-NUMBERS.
   ii. TWO (2) LAYOUT PATTERN PER ASTM E1155-87. 45 DEGREE ANGLES TO THE LONGEST BOUNDARY (X PATTERN). EASIER TO RUN LESS TIME TO RUN PATTERN. MUST BE USED FOR NARROW WIDTH FLOOR SLAB POURS. 90 DEGREE ANGLE TO THE LONGEST BOUNDARY (+ PATTERN).
   iii. PERFORM THE FLOOR FLATNESS AND LEVELNESS TESTING AS FOLLOWS: MINIMUM OF THE FIRST THREE SLAB POURS. MINIMUM OF EVERY OTHER SLAB POUR AFTER THE FIRST THREE SLAB POURS. TESTING MUST BE PERFORMED WITHIN 48 HOURS AFTER SLAB IS POURED. THE RESULTS OF THE TESTING MUST BE REPORTED TO THE CONTRACTOR WITH 24 HOURS.
   iv. AT CONSTRUCTION JOINTS SPECIFY THE FOLLOWING: SPECIFY THAT ALL CONSTRUCTION JOINTS MUST BE CHECKED WITH A 10-FOOT STRAIGHT EDGE CENTERED ON THE CONSTRUCTION JOINT. ANY JOINT THAT DOES NOT MEET WITH A 1/8 INCH OR LESS GAP UNDER THE STRAIGHT EDGE EITHER AT THE CENTER (JOINT TOO LOW) OR AT THE ENDS (JOINT TOO HIGH STRAIGHT EDGE ROCKS) WILL REQUIRE GRINDING UNTIL THE 1/8 INCH TOLERANCE IS ET OR THE JOINT IS ACCEPTABLE. THE CONSTRUCTION JOINTS MUST BE CHECKED WITHIN 48 HOURS AFTER THE LAST ABUTTING SLAB IS POURED.
   iv. TEST RESULTS WILL BE REPORTED IN WRITING TO ARCHITECT/ENGINEER, THE OWNER AND CONTRACTOR WITHIN 24 HOURS AFTER TEST. REPORTS OF COMPRESSIVE STRENGTH TEST SHALL CONTAIN THE PROJECT IDENTIFICATION NAME AND NUMBER, DATE OF CONCRETE PLACEMENT, NAME OF CONCRETE TESTING SERVICE, CONCRETE TYPE AND CLASS, LOCATION OF CONCRETE BATCH IN STRUCTURE, DESIGN COMPRESSIVE STRENGTH AT 28 DAYS, CONCRETE MIX PROPORTIONS AND MATERIALS; COMPRESSIVE STRENGTH, BREAKING LOAD AND TYPE OF BREAK FOR BOTH 7-DAY AND 28-DAYS TEST.
   v. NONDESTRUCTIVE TESTING: IMPACT HAMMER, SONOSCOPE, OR OTHER NONDESTRUCTIVE DEVICE MAY BE PERMITTED BUT SHALL NOT BE USED AS THE SOLE BASIS FOR ACCEPTANCE OR REJECTION.
   vi. ADDITIONAL TESTS: THE TESTING SERVICE WILL MAKE ADDITIONAL TEST OF IN-PLACE CONCRETE WHEN TEST RESULTS INDICATE SPECIFIED CONCRETE STRENGTHS AND OTHER CHARACTERISTICS HAVE NOT BEEN ATTAINED IN THE STRUCTURE, AS DIRECTED BY ARCHITECT/ENGINEER. TESTING SERVICE MAY CONDUCT TESTS TO DETERMINE ADEQUACY OF CONCRETE BY CORED CYLINDERS COMPLYING WITH ASTM C42, OR BY OTHER METHODS AS DIRECTED. CONTACTOR SHALL PAY FOR SUCH TEST WHEN UNACCEPTABLE CONCRETE IS VERIFIED

CARE AND MAINTENANCE OF CONCRETE PAVEMENT

MANY OWNERS DO NOT RECOGNIZE THE NEED FOR MAINTENANCE AND MONITORING OF EXTERIOR CONCRETE PRODUCTS UNTIL THE DETERIORATION IS TOO SEVERE TO BE IGNORED. AT THIS POINT EXPENSIVE AND EXTENSIVE REPAIRS ARE NECESSARY. MOST EXTERIOR CONCRETE PRODUCTS GENERALLY PERFORM FOR MANY YEARS WITH MINIMAL MAINTENANCE AND LITTLE REPAIR COSTS. HOWEVER, THERE ARE EXCEPTIONS, AND EVEN THE MOST WELL IN TENDED MIX DESIGN AND CONSTRUCTION EFFORTS MAY RESULT IN FAILURES AND DISTRESS.

IT IS RECOMMENDED TO INSPECT EXTERIOR CONCRETE PRODUCTS IN THE SPRING AND BEFORE WINTER EACH YEAR. THIS WILL ALLOW THE INSPECTOR TO DETERMINE WHAT REPAIRS AND OR TREATMENTS NEED TO BE PERFORMED TO THE SURFACE TO PREVENT FURTHER DETERIORATION.

ROUTINE SERVICE CONDITIONS THAT AFFECT MONITORING AND MAINTENANCE INCLUDE EXPOSURE TO AGGRESSIVE CHEMICALS, CYCLES OF FREEZING AND THAWING, AND TRAFFIC LOADING. MOST SURFACE DETERIORATION IS CAUSED BY THE USE OF DEICING CHEMICALS AND BY MOISTURE INTRUSION CAN BE A SERIOUS PROBLEM. PROPER AIR ENTRAINMENT AND ADEQUATE CURING BEFORE THE SURFACE IS EXPOSED TO DEICING CHEMICALS AND FREEZE-THAW CYCLES IS ESSENTIAL. IF CONCRETE STARTS TO SHOW SIGNS OF INADEQUATE DURABILITY, IT IS UNDOUBTEDLY POROUS AND ABSORBS GREAT AMOUNTS OF MOISTURE. SURFACE SPALLING FROM FREEZE-THAW ACTION AND STEEL CORROSION FROM SALT INTRUSION CAN RESULT, SO MORE POSITIVE PROTECTION IS NECESSARY. PRIOR TO ANY APPLICATION OF SEALER, THE CONCRETE SHOULD BE CLEANED AND ALLOWED TO DRY FOR 24 HOURS AT A TEMPERATURE ABOVE 60 DEGREES. SOME OLD CONCRETE ESPECIALLY DIRTY, CONCRETE MAY REQUIRE A MORE RIGOROUS PREPARATION OF THE SURFACE. THE USE OF A SILOXANE/SILANE SEALER IS RECOMMENDED. THE SILOXANE/SILANE WATER REPELLENT IS AN EFFECTIVE CHLORIDE SCREEN PROTECTING THE CONCRETE FROM DEICING CHEMICALS ALONG WITH STRONG WATER REPELLENCY. THIS PRODUCT SHOULD BE USED EVERY 3 - 5 YEARS DEPENDING ON THE SERVICE CONDITIONS. AN INSPECTION OF THE WATER REPELLENCY SHOULD BE PERFORMED PRIOR TO DETERMINING RESEALING.

JOINTS IN CONCRETE PARKING LOTS ARE FREQUENTLY SEALED, BUT IN MANY SUCCESSFULLY PERFORMING PARKING LOTS THE JOINTS ARE NOT SEALED. CLOSE JOINT SPACING AND PROPER DRAINAGE WILL MINIMIZE THE INFILTRATION OF WATER THROUGH JOINTS INTO THE SUB-BASE. AUTOMOBILE AND LIGHT TRUCK TRAFFIC WILL NOT CAUSE PUMPING OF UNSEALED JOINTS UNDER MOST CONDITIONS. IN THE EVENT THAT POOR SUBSOIL CONDITIONS AND HEAVY TRUCK TRAFFIC WARRANT EXTRA PRECAUTIONS AND COSTS, EITHER COLD-POURED OR HOT -POURED SEALING MATERIALS CAN BE USED. PREFORMED MATERIALS, COMMON IN HIGHWAY PAVEMENTS, ARE SELDOM USED IN PARKING LOTS. PRIOR TO SEALING, THE JOINT OPENING SHOULD BE THOROUGHLY CLEANED TO REMOVE ALL FOREIGN MATTER. ALL CONTACT FACES OF THE JOINT SHOULD BE CLEANED TO REMOVE LOOSE MATERIAL AND SHOULD BE SURFACE DRY WHEN HOT-POURED SEALING MATERIALS ARE USED. SEALING MATERIALS SHOULD BE CAREFULLY INSTALLED SO THAT SEALANTS WILL NOT BE SPILLED ON EXPOSED CONCRETE. ANY EXCESS MATERIALS ON THE SURFACE OF THE CONCRETE SHOULD BE REMOVED IMMEDIATELY AND THE PAVEMENT SURFACE CLEANED. CRACKS CAN BE ROUTED AND SEALED; THIS WILL REDUCE CONCRETE SPALLING AT THE CRACK FACES AND PREVENT WATER PENETRATION.

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Certification:

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Performed for:

Site Specifications:
goshen public library
Parking & MEP Renovations
601 South 5th Street, Goshen, Indiana 46526

Drawing Revisions
Addendum 1 - 07-24-2024

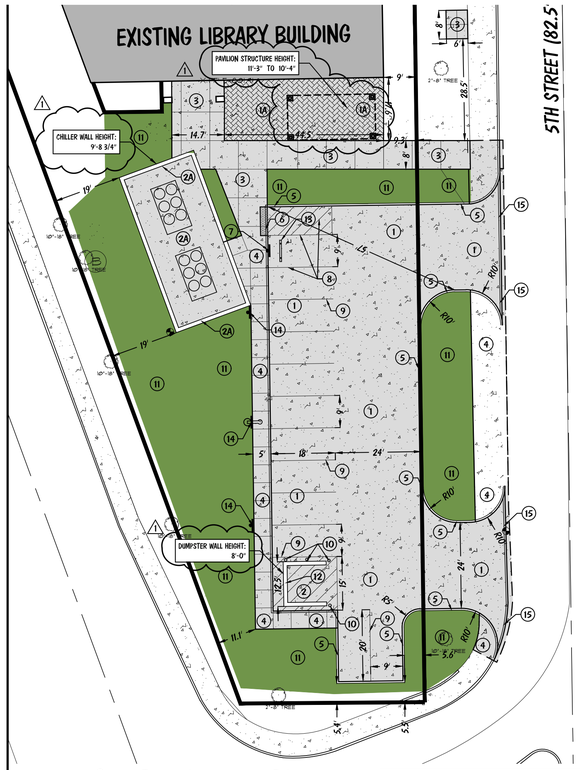
Commission Number
233695

Date
June 26th, 2024

Title
Site Specifications

Sheet Number
C0.2

PERMIT REVIEW SET - NOT FOR CONSTRUCTION



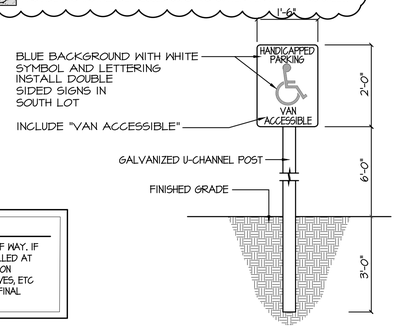
Site Development Plan
Scale: 1" = 20'

GENERAL NOTE: IRRIGATION

SITE IRRIGATION IS TO BE LOCATED OUTSIDE OF PUBLIC RIGHT OF WAY. IF NOT POSSIBLE, IT SHOULD BE KEPT 1' BACK OF WALK AND INSTALLED AT OWNERS RISK. SITE CONTRACTOR TO COORDINATE WITH IRRIGATION CONTRACTOR ON LOCATION OF ANY NEW IRRIGATION LINES, VALVES, ETC PRIOR TO THE INSTALLATION OF ANY PAVED AREAS, CURBS OR FINAL SEEDING/LANDSCAPING.

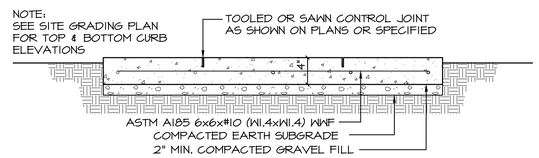
CONSTRUCTION NOTES: GRADING AND PAVING

1. PROVIDE AND INSTALL STANDARD CONCRETE PAVEMENT PER DETAIL THIS SHEET.
2. PROVIDE AND INSTALL STAMPED CONCRETE PAVEMENT PER CONCRETE SIDEWALK DETAIL THIS SHEET. CONTRACTOR TO COORDINATE EXACT STYLE WITH ARCHITECT AND OWNER.
3. PROVIDE AND INSTALL CONCRETE DUMPSTER PAD PER DETAIL THIS SHEET.
4. PROVIDE AND INSTALL CONCRETE MECHANICAL PAD AND ENCLOSURE PER MECHANICAL AND ARCHITECTURAL DETAILS AND SPECIFICATIONS.
5. PROVIDE AND INSTALL CONCRETE WALK PER DETAILS THIS SHEET.
6. PROVIDE AND INSTALL INTEGRAL CONCRETE CURB AND WALK PER DETAIL THIS SHEET.
7. PROVIDE AND INSTALL 6" CONCRETE CURB PER DETAIL THIS SHEET. CURB TO TAPER FROM 6" TO FLUSH AT SIDEWALK PER DETAIL THIS SHEET.
8. PROVIDE AND INSTALL DETECTABLE WARNING PLATE PER DETAIL THIS SHEET. REFER TO SHEET C2.1 FOR DETAILED GRADING INFORMATION THIS AREA.
9. PROVIDE AND INSTALL HANDICAP SIGN PER DETAIL THIS SHEET.
10. PROVIDE AND INSTALL ACCESSIBLE PARKING PAVEMENT STRIPING (BLUE) AS SHOWN ON PLANS PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH PROJECT AND MANUFACTURER'S SPECIFICATIONS AND INDIANA CODE 5-16-4-4.
11. PROVIDE AND INSTALL PASSENGER CAR PAVEMENT STRIPING (WHITE) AS SHOWN ON PLANS PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND MANUFACTURER'S SPECIFICATIONS.
12. PROVIDE AND INSTALL PROTECTIVE BOLLARD PER DETAIL THIS SHEET.
13. PROVIDE A MINIMUM OF 6" OF CLEAN FERTILE TOPSOIL CAPABLE OF SUSTAINING LAWN GROWTH. PROVIDE AND SEED LAWN IN ACCORDANCE WITH PROJECT SPECIFICATIONS. REFURBISH DAMAGED LAWN AREAS IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
14. PROVIDE AND INSTALL DUMPSTER ENCLOSURE FENCE PER ARCHITECTURAL DETAILS AND SPECIFICATIONS.
15. PROVIDE AND INSTALL CONCRETE WHEELSTOP PER DETAIL SHEET C2.1.
16. PROVIDE AND INSTALL NO TRUCK PARKING SIGNS
17. PROVIDE AND INSTALL DEPRESSED CURB AND GUTTER PER DETAIL THIS SHEET.



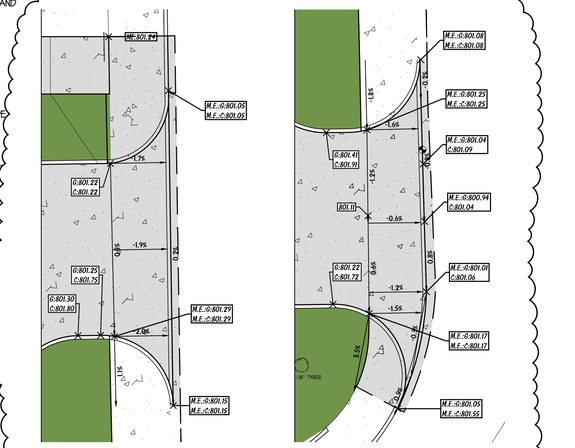
Handicap Sign Detail
Not To Scale

NOTE:
SEE SITE GRADING PLAN FOR TOP & BOTTOM CURB ELEVATIONS



NOTE:
WHERE SIDEWALK TERMINATES ALONG A BUILDING FOUNDATION, A 1/2" THICK PRE-MOLDED EXPANSION JOINT SHALL BE INSTALLED BETWEEN THE WALK AND BUILDING. EXPANSION JOINTS SHALL ALSO BE PLACED AT THE BEGINNING AND END OF A DAYS POUR. ALL EXPANSION JOINTS SHALL BE SEALED IN ACCORDANCE WITH PROJECT SPECIFICATIONS.

Concrete Sidewalk Detail
Not To Scale

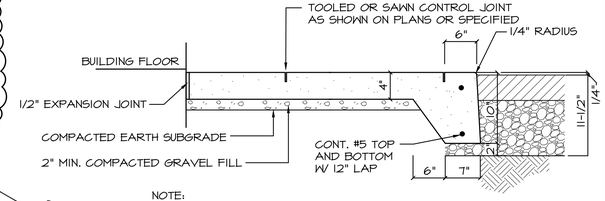


Enlarged North Approach Detail
Not To Scale

Enlarged South Approach Detail
Not To Scale

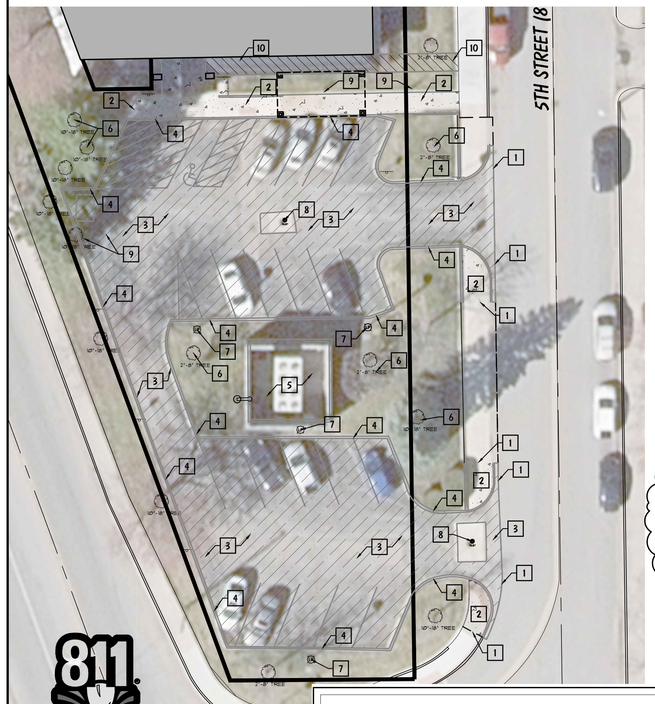
GENERAL NOTES:

1. THE CONTRACTOR SHALL ENSURE THE CONDITION OF ALL EXISTING IMPROVEMENTS INDICATED TO REMAIN. IN ADDITION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF EXISTING UTILITY LINES, AND ENSURE THE PROPER FUNCTIONING OF THESE SERVICES DURING CONSTRUCTION.
2. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY SIGNAGE AND BARRICADES FOR THE PROTECTION AND SAFETY OF VEHICULAR AND PEDESTRIAN TRAFFIC.
3. ALL BACKFILL AND FILL MATERIALS BENEATH LAWNS, PAVED AREAS, AND BUILDINGS SHALL COMPLY WITH PROJECT SPECIFICATIONS.
4. EXISTING TREES, VEGETATION AND LANDSCAPING AREAS NOT INDICATED TO BE REMOVED SHALL BE PROTECTED FROM DAMAGE CAUSED BY CONSTRUCTION ACTIVITIES DURING CONSTRUCTION.
5. POURED-IN-PLACE SITE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI, UNLESS OTHERWISE SPECIFIED.
6. ALL AREAS WITHIN THE CONSTRUCTION LIMITS NOT SPECIFICALLY DESIGNATED TO RECEIVE PAVEMENT, MULCH, OR BUILDING SHALL BE CONSIDERED LAWN AREA. ALL LAWN AREAS SHALL RECEIVE A MINIMUM OF SIX INCHES OF TOPSOIL THAT WILL SUSTAIN LAWN GROWTH.
7. PROPOSED PAVEMENT ELEVATIONS ARE CRITICAL TO MAINTAINING DRAINAGE PATTERNS. ALL ELEVATIONS MUST BE WITHIN TOLERANCES STATED IN PROJECT SPECIFICATIONS AND WILL BE INSPECTED THROUGHOUT, AND AT THE COMPLETION OF, CONSTRUCTION. COORDINATE INSPECTIONS WITH ENGINEER AND SURVEYOR RESPONSIBLE FOR CONSTRUCTION STAKING PRIOR TO INSTALLATION OF ASPHALT PAVEMENT SECTION.
8. FINISH FLOOR ELEVATIONS SHOWN ON THE EXISTING BUILDING ARE FOR REFERENCE ONLY, AND SHOULD NOT BE USED AS A PROJECT BENCHMARK. THE ESTABLISHED PROJECT BENCHMARK AND ITS LOCATION NOTED ON THE CONSTRUCTION DOCUMENTS SHALL BE THE ONLY ACCEPTABLE BENCHMARK FOR THE PURPOSE OF NEW CONSTRUCTION.
9. WHERE SIDEWALK IS CONSTRUCTED IMMEDIATELY ADJACENT TO CURB, THE SURFACE OF THE SIDEWALK SHALL BE CONSTRUCTED 1/2 INCH HIGHER THAN THE TOP OF THE CURB.
10. TRANSVERSE JOINTS SHALL BE CUT WITH A JOINTER HAVING A RADIUS OF 1/2 INCH OF SPACING AS INDICATED OR DIRECTED.
11. COST OF TRANSVERSE PREFORMED JOINT FILLER TO BE INCLUDED IN CONTRACT PRICE FOR CONCRETE SIDEWALK.
12. COMPACTED SUB-GRADE - SUB-GRADE UNDER ALL CURB, SIDEWALKS, AND DRIVES SHALL BE COMPACTED IN ACCORDANCE WITH SECTION 207 OF THE STANDARD SPECIFICATIONS. SPECIAL ATTENTION SHALL BE PAID TO UTILITY TRENCHES. THE UPPER 6 INCHES SHALL COMPLY WITH THE DENSITY REQUIREMENTS OF THE CONTRACT IMMEDIATELY PRIOR TO PLACING THE MATERIAL THEREON. ALL SOFT, YIELDING, OR OTHER UNSUITABLE MATERIAL WHICH CANNOT BE COMPACTED SATISFACTORILY SHALL BE REMOVED. ALL ROCK ENCOUNTERED SHALL BE REMOVED OR BROKEN OFF AT LEAST SIX (6) INCHES BELOW THE SUB-GRADE SURFACE; ANY HOLES OR DEPRESSIONS RESULTING FROM TEH REMOVAL OF UNSUITABLE MATERIAL SHALL BE FILLED WITH SATISFACTORY MATERIAL AND COMPACTED TO CONFORM WITH THE SURROUNDING SUB-GRADE SURFACE.
13. DECORATIVE SIDEWALKS ARE NOT ALLOWED.
14. ADA SIDEWALK RAMPS MUST BE CONCRETE AND CONSTRUCTED IN ACCORDANCE WITH THE MOST RECENT INDOT STANDARDS.
    **WHERE SIDEWALK IS CONSTRUCTED ADJACENT TO THE CURB, THE SPACE BEHIND THE NEW CURB SHALL BE FILLED WITH GRANULAR MATERIAL TO THE REQUIRED ELEVATION AND COMPACTED IN LAYERS NOT TO EXCEED 4 INCHES.
    ***WHERE SIDEWALK IS NOT CONSTRUCTED ADJACENT TO THE CURB, THE SPACE BEHIND THE CURB SHALL BE FILLED WITH SUITABLE MATERIAL TO THE REQUIRED ELEVATION AND COMPACTED IN LAYERS NOT TO EXCEED 4 INCHES.
15. WHEN BUILT IN CONJUNCTION WITH CONCRETE PAVEMENT, EXPANSION AND CONTRACTION JOINTS SHOULD BE PLACED AT THE SAME LOCATIONS AS IN THE PAVEMENT SLAB. THE CURB AND GUTTER SHOULD BE TIED TO THE PAVEMENT BY 1/2 INCH ROUND PREFORMED EPOXY COATED BARS AT APPROXIMATELY 3 FOOT INTERVALS. IF NO CONCRETE PAVEMENT IS BEING BUILT AT THE TIME THE CURB IS CONSTRUCTED, EXPANSION JOINTS SHOULD BE PLACED AT THE ENDS OF ALL RETURNS AND AT INTERVALS NOT TO EXCEED 100 FEET. CONTRACTION JOINTS SHALL BE INSTALLED AT 20 FOOT INTERVALS.



NOTE:
1. WHERE SIDEWALK TERMINATES ALONG A BUILDING FOUNDATION, A 1/2" THICK PRE-MOLDED EXPANSION JOINT SHALL BE INSTALLED BETWEEN THE WALK AND BUILDING. EXPANSION JOINTS SHALL ALSO BE PLACED AT THE BEGINNING AND END OF A DAYS POUR. ALL EXPANSION JOINTS SHALL BE SEALED IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
2. REFER TO GRADING PLAN THIS SHEET FOR LOCATION OF FLUSH WALK.

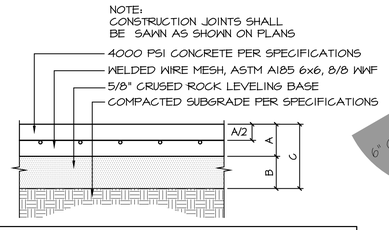
Flush Walk Detail
Not To Scale



Demolition Notes

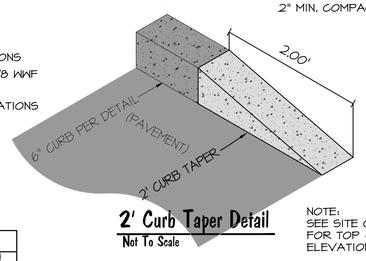
1. SAW CUT EXISTING ASPHALT PAVEMENT/CONCRETE ALONG THIS LINE AND REMOVE AS NOTED.
2. COMPLETELY DEMOLISH AND REMOVE EXISTING CONCRETE WALK AS NOTED.
3. COMPLETELY DEMOLISH AND REMOVE EXISTING ASPHALT PAVEMENT.
4. COMPLETELY DEMOLISH AND REMOVE EXISTING CONCRETE CURB.
5. COMPLETELY DEMOLISH AND REMOVE EXISTING ENCLOSURE, FOUNDATION, AND ASSOCIATED UTILITIES. COORDINATED ANY UTILITY REMOVAL WITH THE LOCAL UTILITY PROVIDER AND MEP CONTRACTORS.
6. COMPLETELY DEMOLISH AND REMOVE EXISTING TREE IN ITS ENTIRETY.
7. EXISTING LIGHT POLE AND BASE TO BE REMOVED. COORDINATE ACTIVITIES WITH ELECTRICAL CONTRACTOR.
8. EXISTING STORM DRYWELL TO BE COMPLETELY DEMOLISHED AND REMOVED. CONTRACTOR TO ENSURE THAT ANY EXISTING PIPING TO THESE STRUCTURES IS REROUTED TO THE NEW INLETS SHOWN SHEET C4.1.
9. REMOVE AND DEMOLISH EXISTING BOLLARDS IN THEIR ENTIRETY.
10. CONTRACTOR TO PROVIDE TEMPORARY PATH FOR INGRESS/EGRESS INTO BUILDING DURING CONSTRUCTION. CONTRACTOR TO COORDINATE WITH LIBRARY OFFICIALS WHEN PATH WILL BE INACCESSIBLE OR NEED TO BE REMOVED FOR CONSTRUCTION.

NOTE:
CONSTRUCTION JOINTS SHALL BE SAWN AS SHOWN ON PLANS



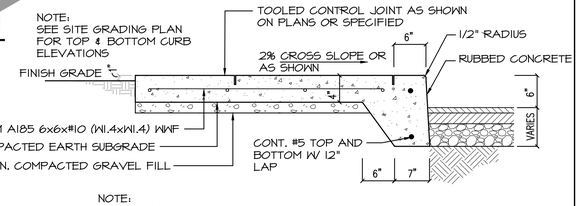
CONCRETE PAVEMENT SCHEDULE				
LOCATION	A	B	C	HATCH SYMBOL
DUMPSTER PAD	8"	6"	14"	
STANDARD CONCRETE PAVEMENT	9"	6"	12"	

Concrete Pavement Detail
Not To Scale



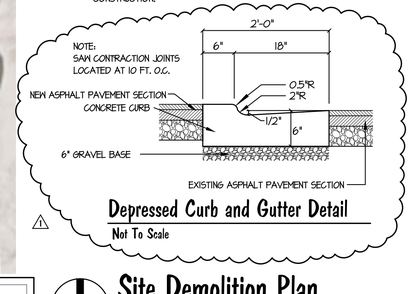
2' Curb Taper Detail
Not To Scale

NOTE:
SEE SITE GRADING PLAN FOR TOP & BOTTOM CURB ELEVATIONS

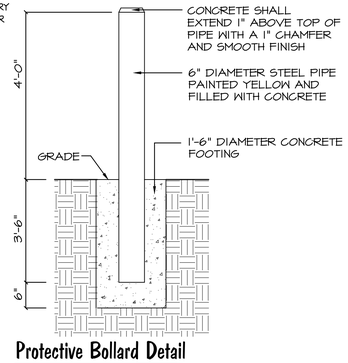


NOTE:
WHERE SIDEWALK TERMINATES ALONG A BULDING FOUNDATION, A 1/2" THICK PRE-MOLDED EXPANSION JOINT SHALL BE INSTALLED BETWEEN THE WALK AND BULDING. EXPANSION JOINTS SHALL ALSO BE PLACED AT THE BEGINNING AND END OF A DAYS POUR.

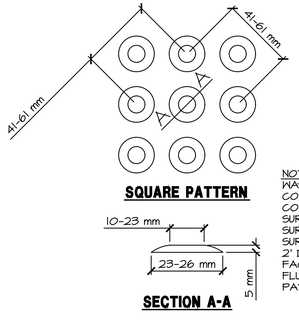
Concrete Curb & Walk Detail
Not To Scale



Depressed Curb and Gutter Detail
Not To Scale



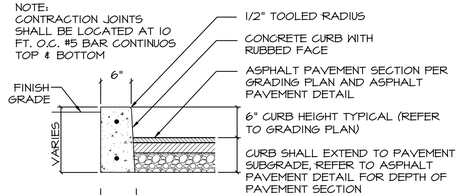
Protective Bollard Detail
Not To Scale



NOTE:
WARNING SURFACE COLOR CONTRASTING TO SURROUNDING SURFACE. WARNING SURFACE INSTALLED 2' DEEP FROM FACE OF WALK FLUSH WITH PAVEMENT.

Truncated Domes for Detectable Warnings
Not To Scale

NOTE:
CONTRACTION JOINTS SHALL BE LOCATED AT 10 FT. O.C. #5 BAR CONTINUOS TOP & BOTTOM



Concrete Curb Detail
Not To Scale

GENERAL NOTE: IRRIGATION

SITE CONTRACTOR TO COORDINATE WITH IRRIGATION CONTRACTOR FOR EXACT LOCATION OF EXISTING IRRIGATION DEMOLITION PRIOR TO SITE EARTH WORK ACTIVITIES.

Site Demolition Plan
Scale: 1" = 20'

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STATE OF INDIANA
PROFESSIONAL ENGINEER

Performed for:

Site Development Plan For:
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Parking & MEP Renovations
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Title
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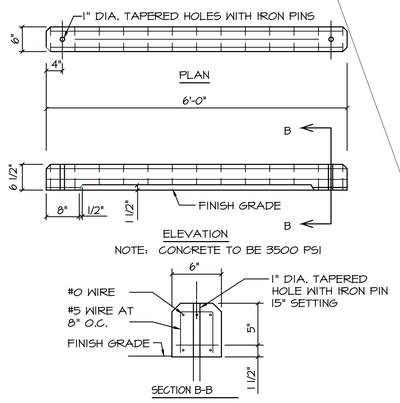
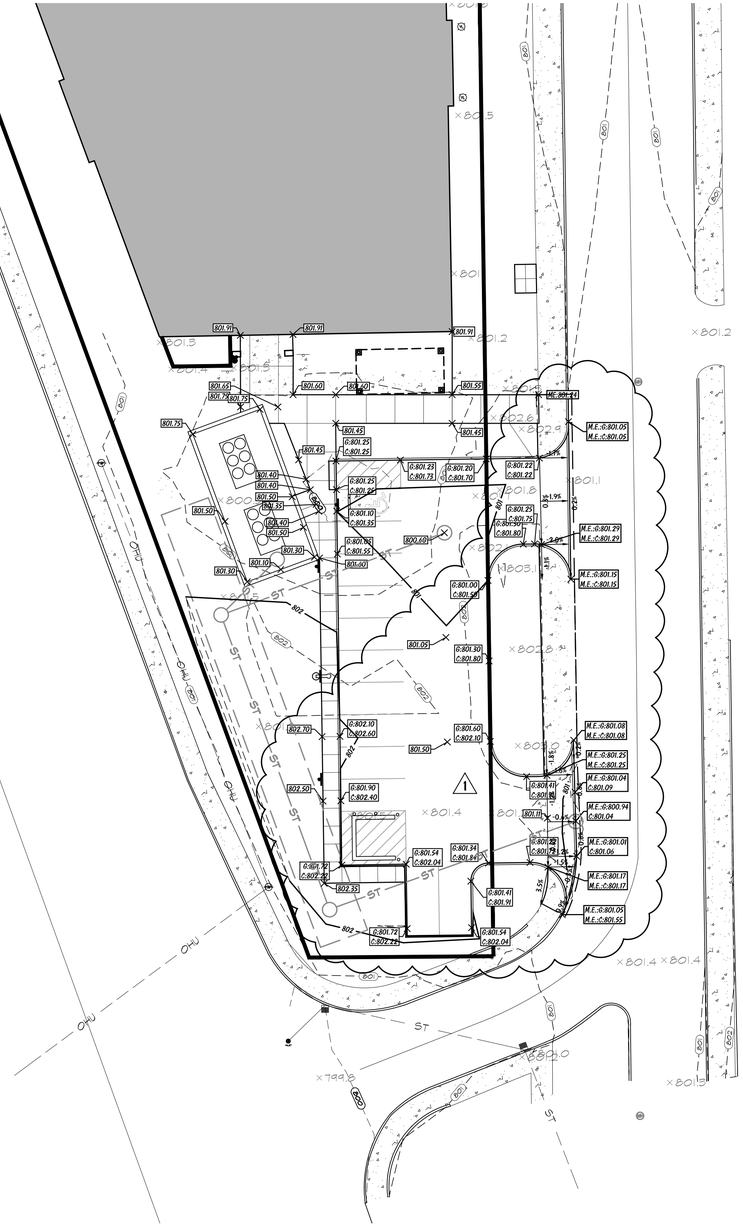


Wheelstop Detail
Not To Scale

GENERAL NOTE:
NO EARTH DISTURBING ACTIVITY MAY COMMENCE WITHOUT AN APPROVED STORM WATER MANAGEMENT PERMIT.



Site Grading Plan
Scale: 1" = 20'

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GENERAL NOTES:

1. THE CONTRACTOR SHALL ENSURE THE CONDITION OF ALL EXISTING IMPROVEMENTS INDICATED TO REMAIN. IN ADDITION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF EXISTING UTILITY LINES, AND ENSURE THE PROPER FUNCTIONING OF THESE SERVICES DURING CONSTRUCTION.
2. EXISTING UTILITY LOCATION SHOWN ON THESE PLANS IS BASED UPON FIELD SURVEY INFORMATION AND RECORD INFORMATION COLLECTED FOR THIS PROJECT. THE ACTUAL LOCATION OF THE EXISTING UTILITIES IS NOT CERTIFIED NOR GUARANTEED BY THE OFFICE OF THE ENGINEER OR ENGINEER.
3. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY SIGNAGE AND BARRICADES FOR THE PROTECTION AND SAFETY OF VEHICULAR AND PEDESTRIAN TRAFFIC.
4. THE CONTRACTOR SHALL COORDINATE ALL MODIFICATIONS, RENOVATIONS OR DISRUPTION OF UTILITY SERVICES WITH THE APPROPRIATE GOVERNING AGENCIES, THE APPROPRIATE LOCAL UTILITY DEPARTMENT, THE OWNER AND THE CONSTRUCTION MANAGER.
5. ALL SITE CLEARING AND EARTHWORK OPERATIONS SHALL BE PERFORMED IN A MANNER TO MINIMIZE INTERFERENCE WITH THE ADJOINING ROADWAYS AND THE OWNER'S FACILITIES. COORDINATE OPERATIONS WITH THE OWNER A MINIMUM OF 5 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
6. REMOVE EXISTING TREES, SHRUBS, GRASS AND OTHER VEGETATION, INCLUDING ALL ROOTS, STUMPS AND BRANCHES, TO A POINT 18" BELOW FINISHED GRADE AS REQUIRED FOR CONSTRUCTION.
7. STRIP TOPSOIL TO WHATEVER DEPTHS ARE ENCOUNTERED IN A MANNER TO PREVENT INTERMINGLING WITH UNDERLYING SUBSOIL OR OTHER WASTE MATERIALS. STRIP SURFACE SOIL OF UNSUITABLE TOPSOIL, INCLUDING TRASH, DEBRIS, WEEDS, ROOTS AND OTHER WASTE MATERIALS. STOCKPILE TOPSOIL ON SITE IN LOCATION AS DIRECTED BY THE OWNER FOR REUSE ON-SITE.
8. EXISTING VEGETATION INDICATED TO BE REMOVED AND RELOCATED SHALL BE PROTECTED DURING EARTHWORK OPERATIONS. ALL VEGETATION SHALL BE RELOCATED AS DIRECTED BY THE OWNER.
9. LEGALLY DISPOSE OF UNSUITABLE TOPSOIL, OBSTRUCTIONS, DEMOLISHED MATERIALS, AND WASTE MATERIALS, INCLUDING TRASH AND DEBRIS OFF OWNER'S PROPERTY. SURPLUS TOPSOIL SHALL BE STORED ON SITE AS DIRECTED BY THE OWNER.
10. ONLY SATISFACTORY SOIL MATERIALS ACCEPTABLE TO, AND APPROVED BY THE OWNER, ENGINEER, AND GEOTECHNICAL ENGINEER SHALL BE USED AS FILL MATERIALS. TYPICALLY THE FOLLOWING CLASSIFICATIONS OF SOIL TYPES MAY BE USED FOR FILL BENEATH STRUCTURES AND PARKING AREAS: ASTM D 2487 SOIL CLASSIFIACTIONS OF GW, GP, GM, SW, SP, AND SM OR A COMBINATION OF THESE SOIL GROUPS.
11. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 6 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT. ALL FILL MATERIAL SHALL BE COMPACTED TO 95% STANDARD PROCTOR.
12. COMPACT SOIL TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557; UNDER PAVEMENTS AND BUILDINGS, SCARIFY AND RECOMPACT THE TOP 12 INCHES OF THE EXISTING SUBGRADE AND EACH LAYER OF FILL MATERIAL AT 95 PERCENT.

GENERAL NOTE: ABBREVIATIONS	
"M.E."	MATCH EXISTING ELEVATION.
"C"	TOP OF CURB ELEVATION.
"G"	GUTTER/BOTTOM OF CURB ELEVATION.
"TC"	TOP OF MANHOLE CASTING. (GUTTER/BOTTOM OF CURB)
"FFE"	FINISH FLOOR ELEVATION.

GENERAL NOTES/SPECIFICATIONS: SITE CLEARING AND EARTHWORK

1. ALL SITE CLEARING AND EARTHWORK OPERATIONS SHALL BE PERFORMED IN A MANNER TO MINIMIZE INTERFERENCE WITH THE ADJOINING ROADWAYS AND THE OWNER'S FACILITIES. COORDINATE OPERATIONS WITH THE OWNER A MINIMUM OF 5 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
2. REMOVE EXISTING TREES, SHRUBS, GRASS AND OTHER VEGETATION INCLUDING ALL ROOTS, STUMPS AND BRANCHES, TO A POINT THAT IS 18" BELOW FINISHED GRADE AS REQUIRED FOR CONSTRUCTION.
3. STRIP TOPSOIL TO WHATEVER DEPTHS ARE ENCOUNTERED IN A MANNER TO PREVENT INTERMINGLING WITH UNDERLYING SUBSOIL OR OTHER WASTE MATERIALS. STRIP SURFACE SOIL OF UNSUITABLE TOPSOIL, INCLUDING TRASH, DEBRIS, WEEDS, ROOTS, AND OTHER WASTE MATERIALS. STOCKPILE TOPSOIL ON SITE AT A LOCATION AS DIRECTED BY THE OWNER FOR REUSE ON-SITE.
4. EXISTING VEGETATION INDICATED TO BE REMOVED AND RELOCATED SHALL BE PROTECTED DURING EARTHWORK OPERATIONS. ALL VEGETATION SHALL BE RELOCATED AS DIRECTED BY THE OWNER.
5. DISPOSE OF EXCESS SOIL, UNSUITABLE TOPSOIL, OBSTRUCTIONS, DEMOLISHED MATERIALS, AND WASTE MATERIALS INCLUDING, TRASH AND TRASH DEBRIS, AND LEGALLY DISPOSE OF THEM OFF OWNER'S PROPERTY.
6. ONLY SATISFACTORY SOIL MATERIALS ACCEPTABLE TO, AND APPROVED BY THE OWNER, ARCHITECT, AND GEOTECHNICAL ENGINEERS SHALL BE USED AS FILL MATERIALS. TYPICALLY THE FOLLOWING CLASSIFICATIONS OF SOIL TYPES MAY BE USED FOR FILL BENEATH STRUCTURES AND PARKING AREAS: ASTM D 2487 SOIL CLASSIFICATIONS OF GW, GP, GM, SW, SP, AND SM OR A COMBINATION OF THESE SOIL GROUPS.
7. IF THE INSTALLATION OF A SEPARATION FABRIC TO REINFORCE THE PAVEMENT STRUCTURE IS REQUIRED THE SEPARATION FABRIC SHALL BE A WOVEN GEOTEXTILE WITH THE FOLLOWING MINIMUM PROPERTIES ACCORDING TO ASTM D 4759:

GRAB TENSILE STRENGTH:	300 LBF ASTM D 4632
TEAR STRENGTH:	75 LBF ASTM D 4533
PUNCTURE RESISTANCE:	90 LBF ASTM D 4833
WATER FLOW RATE:	4 GPM PER SQ. FT. ASTM D 4491
APPARENT OPENING SIZE:	NO. 30 ASTM 4751

8. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 6 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT.
9. COMPACT SOIL TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557:
   UNDER PAVEMENTS, SCARIFY AND RECOMPACT THE TOP 12 INCHES OF THE EXISTING SUBGRADE AND EACH LAYER OF FILL MATERIAL AT 95 PERCENT.
   UNDER LAWN OR UNPAVED AREAS, SCARIFY AND RECOMPACT THE TOP 6 INCHES OF THE EXISTING SUBGRADE AND EACH LAYER OF FILL MATERIAL AT 90 PERCENT.
10. ALL DAMAGED AND RECONDITIONED LAWN AREAS SHALL BE PREPARED AND PLANTED WITH THE FOLLOWING SUN AND PARTIAL SHADE LAWN SEED MIXTURES:

PROPORTIONS	NAME/TYPE
50%	KENTUCKY BLUEGRASS
30%	CHEWINGS RED FESCUE
10%	PERENNIAL RYE GRASS
10%	REDTOP

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Site Grading Plan for:
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Drawing Revisions
⚠ Addendum 1 - 07-24-2024

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Title
Site Grading Plan

Sheet Number
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Site Erosion Control Plan

Scale: 1" = 20'

NORTH

Erosion Control Symbols and Legend

Site Preparation	
Temporary Gravel Entrance/Exit	▨
Topsoil (Salvage and Utilization)	▨
Concrete Washout Area (Signage Required)	▨
Erosion Control Blanket	EB
Surface Stabilization	
Temporary Seeding	TS
Permanent Seeding	PS Maintained Lawn Seed Mix
Sediment Traps and Barriers	
Culvert Protection (Temporary Sediment Trap per detail Sheet C3.3)	CP
Silt Fence (Sediment Fence)	—SF—
Woven Wire Mesh Sediment Barrier	WSB
Outlet Protections	
Rock Chute	RC
Conveyances	
Grass Lined Channel	— · · — · · —
Temporary Drop Inlet Protections	
Basket Inlet Protection (ADS Filter) (Refer to detail on this sheet)	B

GENERAL NOTE: PERMANENT SITE STABILIZATION
UPON PERMANENT AND SATISFACTORY STABILIZATION OF THE PROJECT SITE, THE CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL MEASURES SPECIFIED ON SHEETS C3.1 THROUGH C3.3 AND SHALL SUBMIT A NOTICE OF TERMINATION TO THE LOCAL ENGINEERING DEPARTMENT ALONG WITH COPIES OF FINAL AS-BUILT DRAWINGS TO FORMALLY TERMINATE THE PROJECT AND PROVIDE PROJECT CLOSE OUT.

GENERAL NOTE: STREET CLEANING AND SWEEPING
THE CONTRACTOR SHALL, ON A REGULAR BASIS, CLEAN AND SWEEP THE ADJOINING STREETS AND PAVED SURFACES OF ALL SOIL, MUD AND SEDIMENT TO PROVIDE A CLEAN TRAVEL WAY FOR BOTH CONSTRUCTION AND PUBLIC TRAVEL AND SAFETY.

GENERAL NOTE: ADDITIONAL EROSION CONTROL MEASURES
ADDITIONAL EROSION CONTROL MEASURES AS DEEMED NECESSARY BY THE OWNER, ARCHITECT/ENGINEER AND THE LOCAL GOVERNING AGENCIES SHALL BE PROVIDED, INSTALLED AND MAINTAINED BY THE SITE CONTRACTOR DURING CONSTRUCTION.

Erosion Control Construction Sequence Schedule

STAGE 1 - DAY 1 TO DAY 3
1. INSTALLATION OF SILT FENCE AND CONSTRUCTION ENTRANCE
2. STRIP TOPSOIL WITHIN AREA OF CONSTRUCTION ENTRANCE AND INSTALL CONSTRUCTION ENTRANCE PER DETAIL THIS SHEET.
3. PROVIDE AND INSTALL PERIMETER SEDIMENT FENCING PER EROSION CONTROL PLAN THIS SHEET.
4. PROVIDE AND INSTALL WOVEN WIRE MESH SEDIMENT BARRIER AROUND EXISTING STORM STRUCTURES AS SHOWN ON EROSION CONTROL PLAN THIS SHEET.
5. PROVIDE AND INSTALL CONCRETE WASHOUT PER DETAILS AND SPECIFICATIONS SHEET C3.2-C3.3. ACTUAL INSTALLATION DAY TO VARY DEPENDING ON CONCRETE SCHEDULE. CONCRETE WASHOUT TO BE INSTALLED MAX ONE DAY BEFORE CONCRETE WORK.

STAGE 2 - DAY 3 TO DAY 10
1. STRIP TOPSOIL WITHIN AREA OF DISTURBED LIMITS AND AS SPECIFIED ON SHEET C3.1.
2. EXCESS TOPSOIL TO BE HAULED FROM SITE AND DISPOSED OF IN A PROPER MANOR.
3. PROVIDE AND INSTALL SEDIMENT FENCE AROUND PERIMETER AND STABILIZE STOCK PILE WITH TEMPORARY SEEDING UPON COMPLETION.

STAGE 2 - DAY 10 TO DAY 40
1. UPON COMPLETION OF STORM SEWER SYSTEM PROVIDE EROSION CONTROL DEVISES SPECIFIED WITHIN THE EROSION CONTROL PLAN THIS SHEET.
2. WHERE NECESSARY, STABILIZE STREAM BANKS AND SLOPES GREATER THAN 5 TO 1 AS EARLY AS POSSIBLE.
3. APPLY TEMPORARY OR PERMANENT STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS WHERE WORK IS DELAYED OR COMPLETED.
4. STABILIZE BARE AREAS IMMEDIATELY WITH GRAVEL AND/OR TEMPORARY VEGETATION AS WORK TAKES PLACE.

STAGE 3 - DAY 40 TO DAY 80
1. UPON COMPLETION OF MASS GRADING SPREAD TOPSOIL STOCKPILE WITHIN GRASS AND LANDSCAPING ARES AT A MINIMUM OF 6". ENSURE THAT TOPSOIL IS CLEAN AND CLEAR OF DEBRE.
2. EXCESS TOPSOIL SHALL BE REMOVED AND HAULED OFF SITE IN AN APROPRIATE MANNER AND THE REMAINDER OF THE STORM WATER DETENTION BASIN SHALL BE CONSTRUCTED TO FINISH GRADE.

STAGE 3 - DAY 80 TO DAY 90
1. ENSURE THAT ALL PERMANENT EROSION CONTROL MEASURES SPECIFIED HAVE BEEN IMPLEMENTED AND REMOVE TEMPORARY EROSION CONTROL MEASURES AS NEEDED.

SECTION THROUGH SEDIMENT BARRIER

FABRICATED SEDIMENT BARRIER CONSISTING 6X6, 10/10 WELDED WIRE MESH FRAMEWORK COVERED WITH ONE OF THE FOLLOWING SEDIMENT FENCE PRODUCTS ENVIROFENCE (MIRAFI) PROPEX SILT STOP (AMOCO) ECONOFENCE (TERRATEX) OR EQUIVALENT

PLAN VIEW OF SEDIMENT BARRIER

ALTERNATIVE TO WELDED WIRE SEDIMENT BARRIER
ADS FLEXSTORM FILTER SYSTEM MAY BE INSTALLED AS AN ALTERNATIVE INLET PROTECTION SYSTEM TO THE WELDED WIRE SEDIMENT BARRIER SHOWN IN THIS DETAIL IN AREAS WHERE PUBLIC ACCESS (PEDESTRIAN AND/ OR VEHICULAR) IS TO BE MAINTAINED DURING CONSTUCTION.

Woven Wire Mesh Sediment Barrier Detail

Not to Scale

SEDIMENT FENCE INSTALLATION SCHEDULE		
LAND SLOPE	DISTANCE BETWEEN FENCE APPLICATIONS	
LESS THAN 2%	100 FEET	MAXIMUM DISTANCES REPRESENT THE RECOMMENDED FENCE SPACING BETWEEN APPLICATIONS, AND THE MAXIMUM UPLAND DISTANCE PRIOR TO THE INSTALLATION OF THE INITIAL SEDIMENT FENCE APPLICATION
2 TO 5%	75 FEET	
5 TO 10%	50 FEET	
10 TO 20%	25 FEET	

Sediment Fence Detail

Not to Scale

NOTE:
THE CONSTRUCTION EXIT SHALL BE CLEANED OF SEDIMENT FREQUENTLY TO ENSURE PROPER FUNCTIONING. THE LAYER OF BROKEN STONE SHALL BE PERIODICALLY REPLACED. THE CONTRACTOR SHALL KEEP ADJOINING ROADWAYS FREE OF SEDIMENTATION.

Construction Entrance Detail

Not to Scale

FLEXSTORM CATCH-IT FILTERS FOR TEMPORARY INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING

ADS Filter Detail

Not to Scale

Know what's **below.**
Call before you dig.

Site Location Map

Not To Scale

NORTH

National Wetlands Inventory Map

Not To Scale

NORTH

National Flood Hazard Layer FIRMette

F.I.R.M. Map

Not To Scale

NORTH

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Todd R Bauer

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Performed for:

Erosion Control Plan for:
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Parking & MEP Renovations
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C3.1

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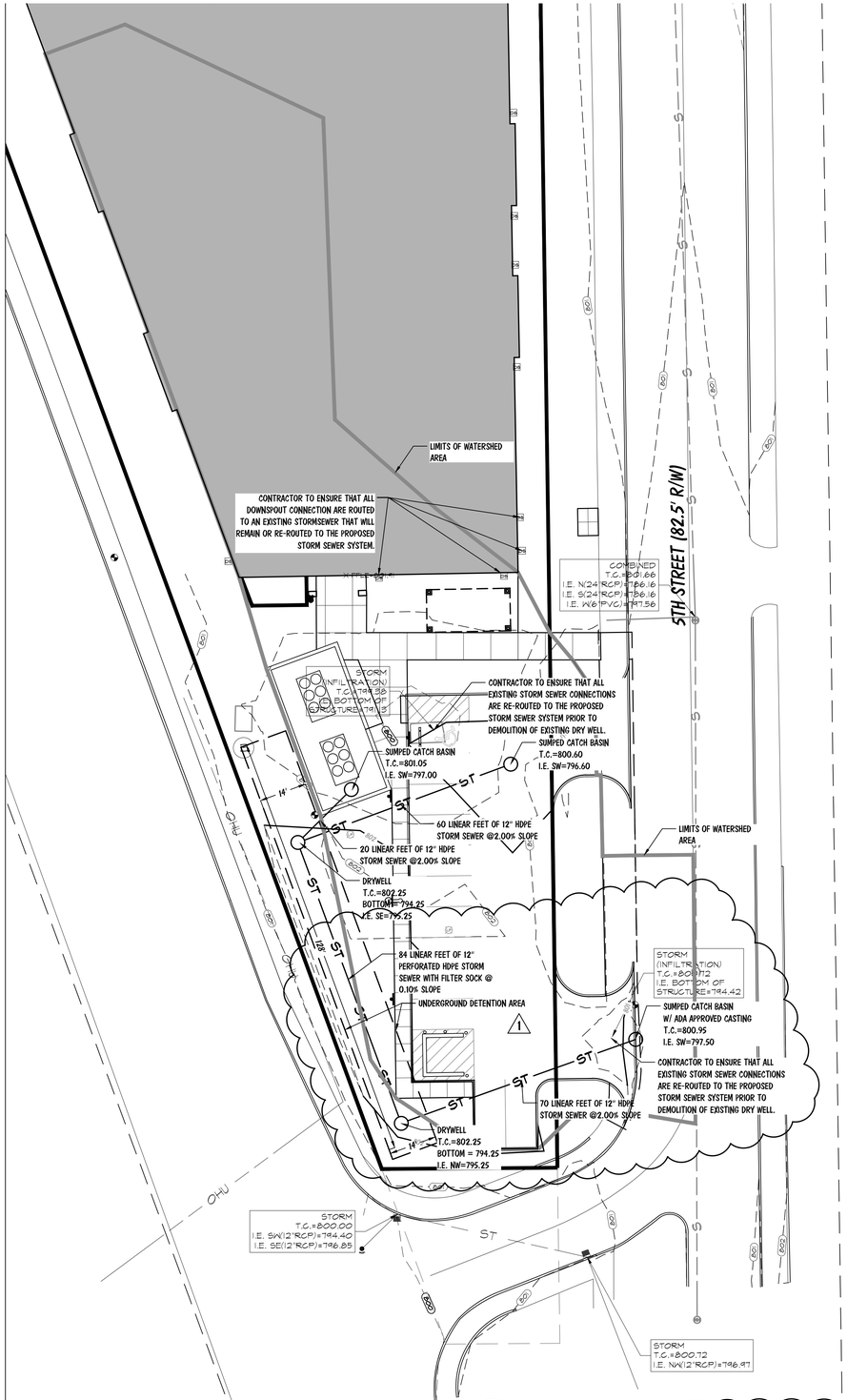


Stormwater Management Plan

Scale: 1" = 20'

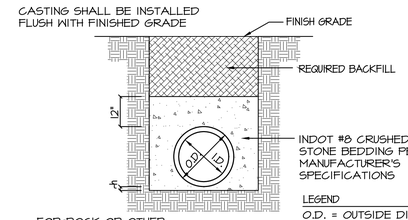
NORTH

⚠ Watershed and Stormwater Infiltration Computations

POST-DEVELOPED STORM SEWER BASINS

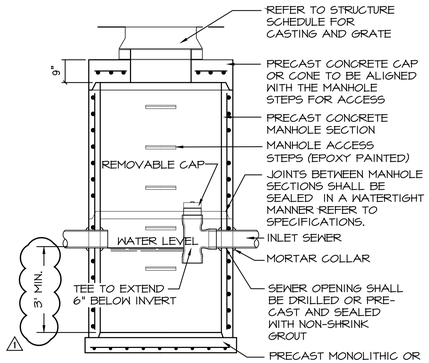
WATERSHED	TOTAL AREA (sq.ft.)	TOTAL AREA (ac)	ROOF (sq.ft.) 1.00	PAVE (sq.ft.) 0.65	LAWN (sq.ft.) 0.30	WEIGHTED RUNOFF C
South Parking	24430	0.56	9480	10975	3975	0.73
TOTAL	24430	0.56	9480	10975	3975	0.73

Stormwater Retention Volume Required	4452	cubic feet
Volume Provided in Pipe and Drywells	260	cubic feet
Volume Provided in 40% Stone Void 128x14x6	4300	cubic feet
Total Volume Provided	4560	cubic feet



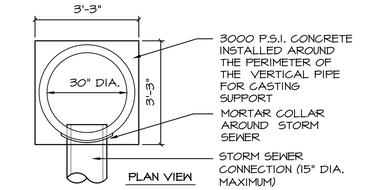
HDPE Pipe Bedding Detail

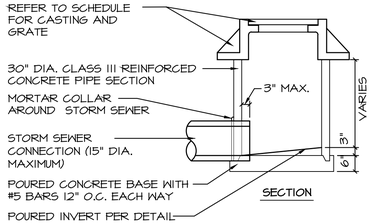
Not To Scale



Catchbasin Detail

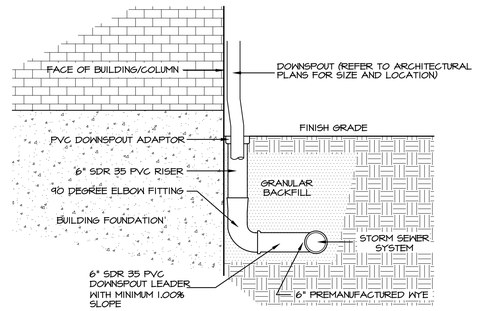
Not To Scale





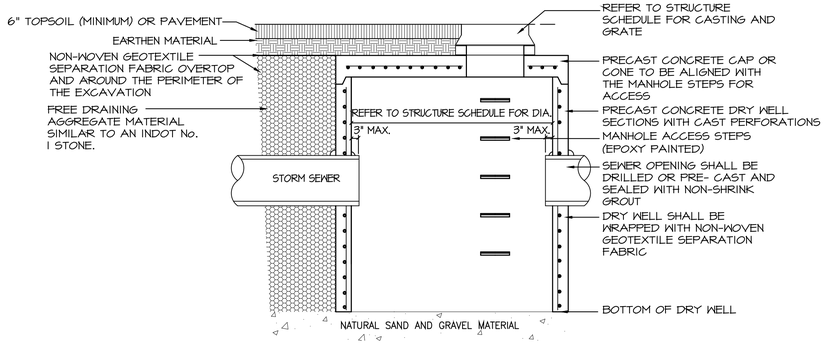
Type I Inlet Detail

Not To Scale



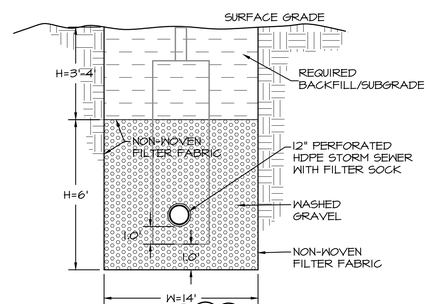
Downspout Connection Detail

Not To Scale



Typical Drywell Detail

Not To Scale



Underground Infiltration Detail

Not To Scale ⚠

GENERAL NOTES: STORM SEWERS

1. ALL SANITARY AND STORM SEWER MATERIALS, WORKMANSHIP AND METHODS OF CONSTRUCTION SHALL COMPLY WITH THE CITY OF GOSHEN ENGINEERING DEPARTMENT SPECIFICATIONS AND DETAILS, LATEST EDITION. APPROVAL OF THESE PLANS DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF THE INSTALLATION IN ACCORDANCE WITH THE CITY OF GOSHEN SPECIFICATIONS AND DETAILS.
2. THE SEWER PIPE BEDDING SHALL BE PER THE LOCAL MUNICIPAL ENGINEERING DEPARTMENT SPECIFICATIONS OR PER DETAILS IN THIS SET, WHICHEVER IS MORE STRINGENT. ALL SEWER INSTALLATION BENEATH PAVED AREAS, ROADWAYS, AND WITHIN ROAD RIGHT-OF-WAYS SHALL RECEIVE FULL DEPTH GRANULAR BACKFILL.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TAPPING AND CONNECTION FEES ASSOCIATED WITH THE SEWER CONSTRUCTION. IN ADDITION, THE CONTRACTOR SHALL PAY FOR A FULL TIME INSPECTOR IF REQUIRED BY THE GOVERNING AUTHORITY.
4. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES, AND THE LOCATION AND INVERT OF THE EXISTING SANITARY AND STORM SEWERS. ANY CONFLICT BETWEEN THE EXISTING UTILITIES AND THE PROPOSED CONSTRUCTION SHOULD BE REPORTED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF CONSTRUCTION OPERATIONS.
5. THE CONTRACTOR SHALL, UPON THE COMPLETION SEWER CONSTRUCTION, VERIFY ALL FINAL MANHOLE RIM ELEVATIONS AND INVERT ELEVATIONS OF THE SANITARY AND STORM SEWER SYSTEM. ADDITIONALLY, THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE GOVERNING AUTHORITIES "AS-BUILT" DRAWINGS CERTIFIED BY A PROFESSIONAL LAND SURVEYOR IN THE STATE OF INDIANA.
6. ALL SEWER TAPS ARE FROM THE MUNICIPAL SEWER MAIN TO A POINT WITHIN FIVE FEET OF THE BUILDING, UNLESS OTHERWISE NOTED.

GENERAL NOTE: ABBREVIATIONS

"(M.E.)"	MATCH EXISTING ELEVATIONS.
"C"	TOP OF CURB ELEVATION.
"G"	GUTTER/BOTTOM OF CURB ELEVATION.
"TC"	TOP OF MANHOLE CASTING.
"DS"	DOWN SPOUTS
"CO"	CLEAN OUT

GENERAL NOTE: NOTIFICATION

THE CONTRACTOR SHALL PROVIDE 48 HOURS NOTICE TO THE LOCAL MUNICIPAL ENGINEERING DEPARTMENT FOR THE INSPECTION OF THE CONNECTION TO THE EXISTING INLET AND 48 HOURS NOTICE TO THE PROPERTY OWNERS PRIOR TO ANY WORK ON OFFSITE LOTS.

GENERAL NOTE: EXISTING DRAINAGE TILES

ANY EXISTING DRAINAGE TILES ENCOUNTERED DURING THE COURSE OF CONSTRUCTION SHALL BE CONNECTED TO THE PROPOSED STORM SEWER NETWORK. COORDINATE METHOD OF CONNECTION WITH THE OFFICE OF THE ENGINEER, OWNER, AND THE LOCAL MUNICIPAL STORMWATER ENGINEERING DEPARTMENT PRIOR TO CONSTRUCTION.

GENERAL NOTE:

NO EARTH DISTURBING ACTIVITY MAY COMMENCE WITHOUT AN APPROVED STORM WATER MANAGEMENT PERMIT.

GENERAL NOTE:

THE STORM SEWER SYSTEM SHALL BE CONSTRUCTED PER DESIGN SPECIFIED AND AS APPROVED BY THE LOCAL MUNICIPAL ENGINEERING DEPEARTMENT ON THE FINAL APPROVED CONSTRUCTION PLANS. DEVIATIONS FROM THE APPROVED DESIGN SHALL ONLY BE PERMITTED DUE TO SPECIAL CIRCUMSTANCES OR DIFFICULTY DURING CONSTRUCTION AND WILL REQUIRE PRIOR FIELD APPROVAL FROM A DESIGNATED REPRESENTATIVE FROM THE LOCAL MUNICIPAL ENGINEERING DEPARTMENT IN ADDITION TO SUPPLEMENTAL APPROVAL BY THE DESIGN ENGINEER. AN EXPLANATION OF ANY SUCH DEVIATION SHALL BE INCLUDED AS A REQUIREMENT ON AS-BUILT/RECORD DRAWINGS SUBMITTED FOR RELEASE OF PERFORMANCE GUARANTEES. APPROVED DESIGN SLOPES IDENTIFIED AS GENERATING VELOCITIES OF 2.5 FPS OR LESS OR 10 FPS OR GREATER (AT FULL FLOW CAPACITY) SHALL REQUIRE AS-BUILT CERTIFICATION AT THE TIME OF CONSTRUCTION, PRIOR TO BACKFILLING THE PIPE. THE CONTRACTOR IS INSTRUCTED TO AS-BUILT EACH SECTION OF STORM PIPE AS IT IS BEING INSTALLED TO ENSURE COMPLIANCE WITH DESIGN PLANS AND AS APPROVED BY THE LOCAL MUNICIPAL ENGINEERING DEPARTMENT

GRADING & DRAINAGE NOTES:

1. ALL GRADES AT BOUNDARY SHALL MEET EXISTING GRADES.
2. ALL SWALES SHALL HAVE A MINIMUM SLOPE OF 1.00%.
3. CONTRACTOR SHALL MINIMIZE DAMAGE TO EXISTING TREES.
4. SLOPE SHALL NOT BE GREATER THAN 3:1 UNLESS OTHERWISE SPECIFIED.
5. REMOVE AND BACKFILL ALL AREAS WHERE ANY FIELD TILE CROSSES PROPOSED BUILDING PADS. ALL FIELD TILES SUBCONTRACTOR SHALL NOTIFY IN WRITING THE OWNER AND THE ENGINEER IN ANY CIRCUMSTANCES WHERE THIS CANNOT BE DONE.
6. ALL FILL AREAS UNDER FLOOR SLABS, ADJACENT TO FOUNDATIONS AND OVER FOUNDATIONS SHOULD COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR DENSITY (ASTM D-698). FILL SUPPORTING FOOTINGS SHOULD BE COMPACTED TO 100% STANDARD PROCTOR DENSITY (ASTM D-698). IN CUT AREAS, WHERE PAVEMENT IS PLANNED, THE UPPER 10" SHOULD BE SCARIFIED AND COMPACTED TO 100% OF THE STANDARD PROCTOR DENSITY (ASTM D-698).
7. THE CONTRACTOR SHALL CONFIRM ALL EARTHWORK QUANTITIES PRIOR TO THE START OF CONSTRUCTION. IF AN EXCESS OR SHORTAGE OF EARTH IS ENCOUNTERED, THE CONTRACTOR SHALL CONFIRM WITH THE OWNER AND ENGINEER THE REQUIREMENTS FOR STOCKPILING, REMOVAL OR IMPORTANT OF EARTH.
8. ANY PART OF STORM SEWER TRENCHES RUNNING UNDER OR WITHIN 5' OF PAVED AREAS IS TO BE BACKFILLED PER CITY STANDARDS.
9. STANDARD SPECIFICATIONS FOR THE LOCAL GOVERNING AUTHORITY SHALL APPLY FOR ALL STORM SEWER CONSTRUCTION.
10. ALL YARD DRAINS SHALL BE NYLOPLAST DRAIN BASINS WITH DOME CASTINGS.

Know what's **below.** **Call** before you dig.

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Certification:

TODD R. BAUER REGISTERED No. 19700312 STATE OF INDIANA PROFESSIONAL ENGINEER

Performed for:

goshen public library

601 South 5th Street, Goshen, Indiana 46526

Stormwater Management Plan for:

Parking & MEP Renovations

Drawing Revisions

⚠ Addendum 1 - 07-24-2024

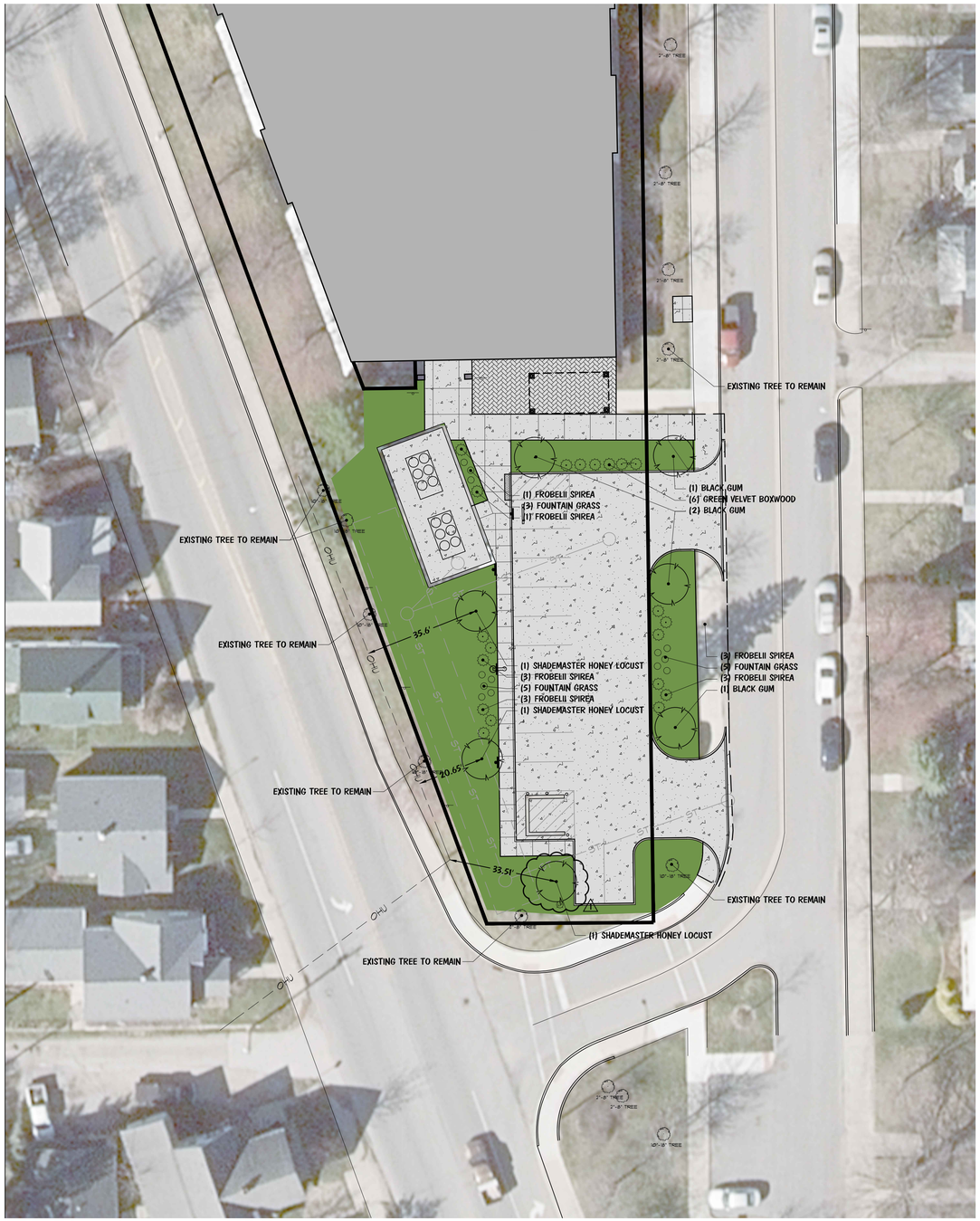
Commission Number: 233695

Date: June 26th, 2024

Title: Stormwater Management Plan

Sheet Number: C4.1

PERMIT REVIEW SET - NOT FOR CONSTRUCTION



Site Landscaping Plan

Scale: 1" = 20

NORTH

PLANT LEGEND

QUANTITY	COMMON NAME	SCIENTIFIC NAME	ROOT	SIZE	HEIGHT AT MATURITY
	DECIDUOUS TREES				
4	BLACK GUM	NYSSA SYLVATICA	B4B	2"	30' - 50'
3	SHADEMASTER HONEY LOCUST	GLEDITSIA TRIACANTHOS VAR INERMIS	B4B	2"	40' - 45'
	SHRUBS				
6	GREEN VELVET BOXWOOD	BUXUS SPP.	CONT.	18"	2' - 4'
14	FROBELII SPIREA	SPIRAEA X FROBELII	CONT.	18"	3' - 3.5'
13	FOUNTAIN GRASS	PENNISETUM ALOPECUROIDES	CONT.	6"	3' - 3.5'

GENERAL NOTES/SPECIFICATIONS: SITE CLEARING AND EARTHWORK

1. ALL SITE CLEARING AND EARTHWORK OPERATIONS SHALL BE PERFORMED IN A MANNER TO MINIMIZE INTERFERENCE WITH THE ADJOINING ROADWAYS AND THE OWNER'S FACILITIES. COORDINATE OPERATIONS WITH THE OWNER A MINIMUM OF 5 WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
2. REMOVE EXISTING TREES, SHRUBS, GRASS AND OTHER VEGETATION INCLUDING ALL ROOTS, STUMPS AND BRANCHES, TO A POINT THAT IS 18" BELOW FINISHED GRADE AS REQUIRED FOR CONSTRUCTION.
3. STRIP TOPSOIL TO WHATEVER DEPTHS ARE ENCOUNTERED IN A MANNER TO PREVENT INTERMINGLING WITH UNDERLYING SUBSOIL OR OTHER WASTE MATERIALS. STRIP SURFACE SOIL OF UNSUITABLE TOPSOIL, INCLUDING TRASH, DEBRIS, WEEDS, ROOTS, AND OTHER WASTE MATERIALS. STOCKPILE TOPSOIL ON SITE AT A LOCATION AS DIRECTED BY THE OWNER FOR REUSE ON-SITE.
4. EXISTING VEGETATION INDICATED TO BE REMOVED AND RELOCATED SHALL BE PROTECTED DURING EARTHWORK OPERATIONS. ALL VEGETATION SHALL BE RELOCATED AS DIRECTED BY THE OWNER.
5. DISPOSE OF EXCESS SOIL, UNSUITABLE TOPSOIL, OBSTRUCTIONS, DEMOLISHED MATERIALS, AND WASTE MATERIALS INCLUDING, TRASH AND TRASH DEBRIS, AND LEGALLY DISPOSE OF THEM OFF OWNER'S PROPERTY.
6. ONLY SATISFACTORY SOIL MATERIALS ACCEPTABLE TO, AND APPROVED BY THE OWNER, ARCHITECT, AND GEOTECHNICAL ENGINEERS SHALL BE USED AS FILL MATERIALS. TYPICALLY THE FOLLOWING CLASSIFICATIONS OF SOIL TYPES MAY BE USED FOR FILL BENEATH STRUCTURES AND PARKING AREAS: ASTM D 2487 SOIL CLASSIFICATIONS OF GW, GP, GM, SW, SP, AND SM OR A COMBINATION OF THESE SOIL GROUPS.
7. IF THE INSTALLATION OF A SEPARATION FABRIC TO REINFORCE THE PAVEMENT STRUCTURE IS REQUIRED THE SEPARATION FABRIC SHALL BE A WOVEN GEOTEXTILE WITH THE FOLLOWING MINIMUM PROPERTIES ACCORDING TO ASTM D 4759:

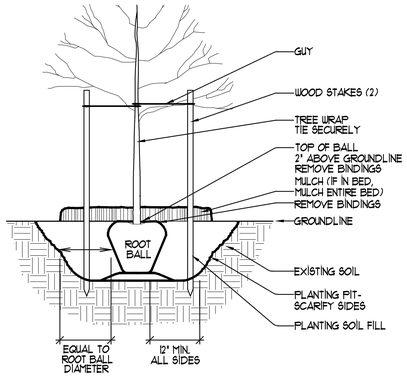
GRAB TENSILE STRENGTH:	300 LBF ASTM D 4632
TEAR STRENGTH:	75 LBF ASTM D 4533
PUNCTURE RESISTANCE:	90 LBF ASTM D 4833
WATER FLOW RATE:	4 GPM PER SQ. FT. ASTM D 4491
APPARENT OPENING SIZE:	NO. 30 ASTM 4751

8. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 6 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT.
9. COMPACT SOIL TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557:
   UNDER PAVEMENTS, SCARIFY AND RECOMPACT THE TOP 12 INCHES OF THE EXISTING SUBGRADE AND EACH LAYER OF FILL MATERIAL AT 95 PERCENT.
   UNDER LAWN OR UNPAVED AREAS, SCARIFY AND RECOMPACT THE TOP 6 INCHES OF THE EXISTING SUBGRADE AND EACH LAYER OF FILL MATERIAL AT 90 PERCENT.
10. ALL DAMAGED AND RECONDITIONED LAWN AREAS SHALL BE PREPARED AND PLANTED WITH THE FOLLOWING SUN AND PARTIAL SHADE LAWN SEED MIXTURES:

PROPORTIONS	NAME/TYPE
50%	KENTUCKY BLUEGRASS
30%	CHEWINGS RED FESCUE
10%	PERENNIAL RYE GRASS
10%	REDTOP

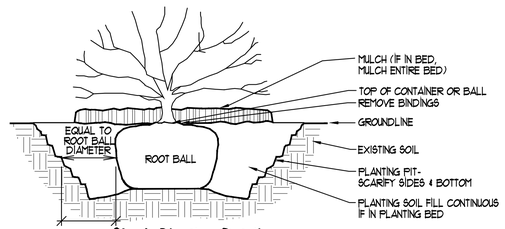
GENERAL LANDSCAPE NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE LANDSCAPE PLAN SHEET L1.1.
2. ALL NECESSARY PERMITS AND APPROVALS FROM AGENCIES GOVERNING THE LANDSCAPE WORK SHALL BE SECURED BY CONTRACTOR PRIOR TO BEGINNING ANY WORK.
3. THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR KEEPING ALL ROADS, WALKS, AND ADJACENT PROPERTIES CLEAR OF ALL LANDSCAPE CONSTRUCTION EQUIPMENT, DIRT, AND OTHER DEBRIS.
4. THE LANDSCAPE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LINE LOCATIONS PRIOR TO ANY CONSTRUCTION. ANY DEVIATIONS FROM THE DESIGN LOCATIONS SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT.
5. THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND SCHEDULING ALL LANDSCAPING RELATED WORK WITH OTHER CONTRACTORS AND TRADES.
6. THE LANDSCAPE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT IMMEDIATELY IF ANY DISCREPANCIES IN THE CONSTRUCTION DOCUMENTS ARE FOUND.
7. THE LANDSCAPE CONTRACTOR IS NOT RESPONSIBLE FOR ROUGH GRADING. THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR FINE GRADING IN ALL LAWN AREAS. THE SITE OR GRADING CONTRACTOR SHALL DEVELOP THE SITE GRADES TO WITHIN 1 INCH OF FINE GRADE. THIS SHALL INCLUDE TOPSOIL, IF AVAILABLE.
8. THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR PROVIDING AND INSTALLING APPROVED PLANTING SOIL MIX. TILL THE EXISTING SUBGRADE TO MINIMUM DEPTH OF 8" PRIOR TO INSTALLING THE PLANTING SOIL MIX. THE FOLLOWING AREAS SHALL RECEIVE APPROVED PLANTING SOIL MIX PER THE PLANTING DETAILS:
   1) Shrub Planting Pits 2) Tree Planting Pits
9. ANY SERIES OF TREES OR SHRUBS TO BE PLACED IN A PARTICULAR ARRANGEMENT MAY BE FIELD CHECKED ANDAPPROVED BY THE LANDSCAPE ARCHITECT FOR ACCURACY OF SPACING PRIOR TO PLANTING. ANY PLANTS NOT ARRANGED PER THE LANDSCAPE PLANS WILL BE RELOCATED AT THE EXPENSE OF THE LANDSCAPE CONTRACTOR.
10. CONTRACTOR TO LOOSEN SUBSOIL IN ALL PLANTING AREAS PER SPECIFICATIONS.
11. APPLY HERBICIDE TO PLANT BEDS PRIOR TO PLANTING FOR WEED CONTROL. FOLLOW LABEL DIRECTIONS. DO NOT APPLY TO ANY PLANTING BEDS THAT MAY RESULT IN DAMAGE TO PLANT MATERIALS.
12. PLANTING BEDS TO HAVE A MINIMUM OF 3" PROCESSED SHREDDED HARDWOOD MULCH, UNLESS OTHERWISE NOTED. ALL SHRUBS TO BE INCLUDED IN A MULCHED BED AS INDICATED ON PLANS. TREES TO HAVE A 4' DIAMETER CIRCLE OF 3" PROCESSED SHREDDED HARDWOOD MULCH.
13. DIMENSION FOR HEIGHT AND SPREAD OF PLANT MATERIAL SPECIFIED ON THE PLANT LIST ARE GENERAL GUIDES FOR THE MINIMUM DESIRED SIZE OF EACH PLANT. EACH PLANT SHALL HAVE A UNIFORM AND CONSISTENT SHAPE AS IT PERTAINS TO THE SPECIFICATIONS AND PARTICULAR SPECIES. ANY PLANT MATERIAL WHICH FAILS TO CONFORM TO THE SPECIFICATIONS IS SUBJECT TO RELJECTION BY THE LANDSCAPE ARCHITECT.
14. THE QUANTITIES INDICATED ON THE PLANT LIST ARE PROVIDED FOR THE BENEFIT OF THE LANDSCAPE CONTRACTOR, BUT SHOULD NOT BE ASSUMED TO ALWAYS BE CORRECT. IN THE EVENT OF A DISCREPANCY, THE PLANTING PLANS WILL TAKE PRECEDENCE OVER THE PLANT LIST. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR QUANTITIES, CALCULATIONS AND THE LIABILITY PERTAINING TO THOSE QUANTITIES AND ANY RELATED CONTRACT DOCUMENTS AND/OR PRICE QUOTATIONS.
15. ALL PLANTING BEDS ADJACENT TO THE BUILDING SHALL HAVE A MINIMUM SLOPE OF 2% AWAY FROM THE BUILDING TO INSURE POSITIVE DRAINAGE.
16. REFER TO CIVIL PLANS FOR SITE GRADING AND UTILITY PLANS.



Tree Planting Detail

Not To Scale



Shrub Planting Detail

Not To Scale

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Performed for:

Site Landscaping Plan for:
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Parking & MEP Renovations
601 South 5th Street, Goshen, Indiana 46526

Drawing Revisions

⚠1 Addendum 1 - 07-24-2024

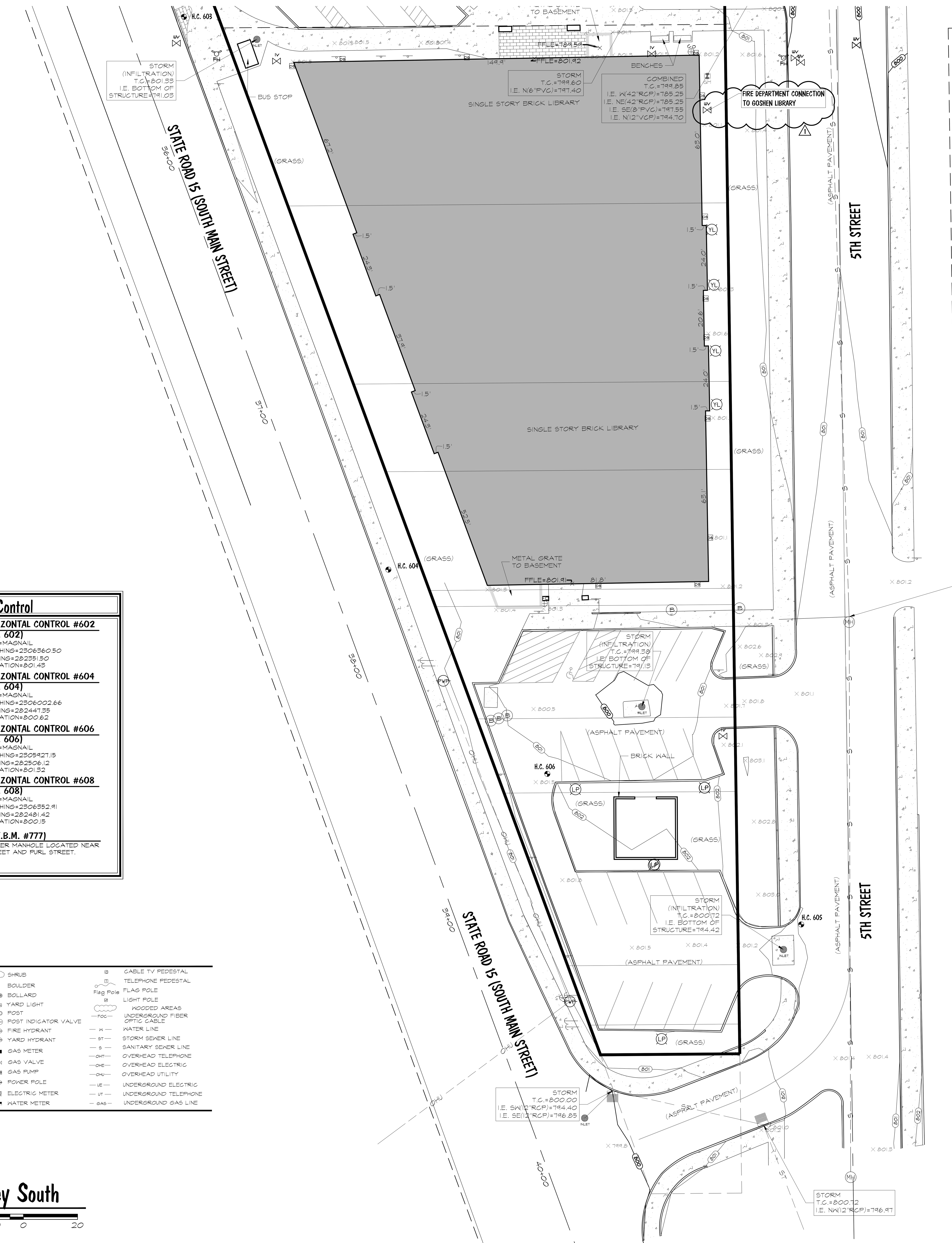
Commission Number
233695

Date
June 26th, 2024

Title
Site Landscape Plan

Sheet Number
L1.1

PERMIT REVIEW SET - NOT FOR CONSTRUCTION



Horizontal and Vertical Control

HORIZONTAL CONTROL #601 (H.C. 601)
TYPE=MAGNAIL
NORTHING=2306472.34
EASTING=282310.92
ELEVATION=800.80

HORIZONTAL CONTROL #602 (H.C. 602)
TYPE=MAGNAIL
NORTHING=2306360.50
EASTING=282351.50
ELEVATION=801.43

HORIZONTAL CONTROL #603 (H.C. 603)
TYPE=MAGNAIL
NORTHING=2306206.97
EASTING=282371.74
ELEVATION=801.30

HORIZONTAL CONTROL #604 (H.C. 604)
TYPE=MAGNAIL
NORTHING=2306002.66
EASTING=282447.35
ELEVATION=800.62

HORIZONTAL CONTROL #605 (H.C. 605)
TYPE=MAGNAIL
NORTHING=2305871.49
EASTING=282599.99
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HORIZONTAL CONTROL #606 (H.C. 606)
TYPE=MAGNAIL
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ELEVATION=801.32

HORIZONTAL CONTROL #607 (H.C. 607)
TYPE=MAGNAIL
NORTHING=2306247.73
EASTING=282586.20
ELEVATION=799.93

HORIZONTAL CONTROL #608 (H.C. 608)
TYPE=MAGNAIL
NORTHING=2306352.91
EASTING=282481.42
ELEVATION=800.15

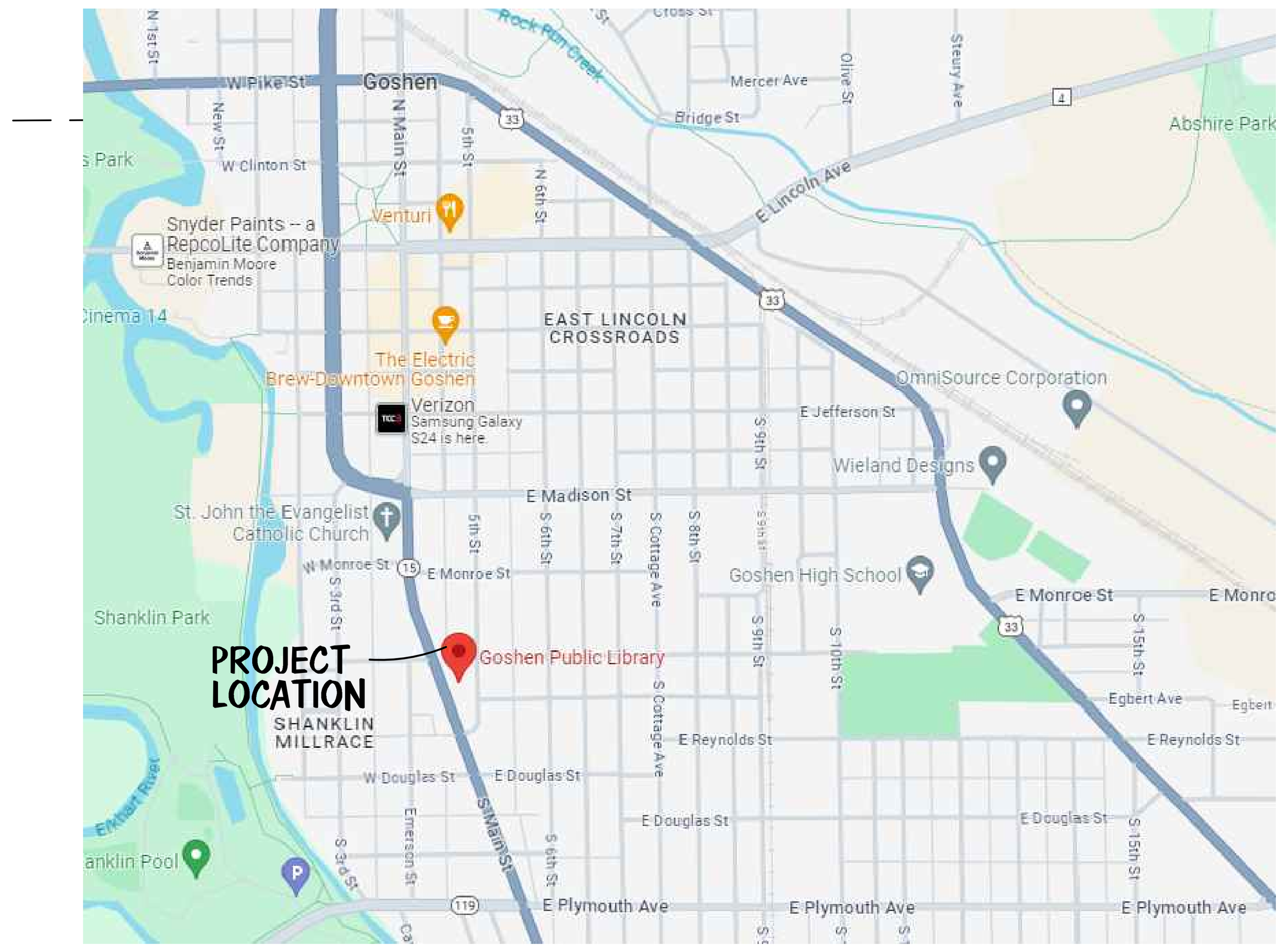
TEMPORARY ONSITE BENCHMARK #777 (T.B.M. #777)
THE NORTH RIM OF AN EXISTING COMBINED SEWER MANHOLE LOCATED NEAR THE CENTER OF THE INTERSECTION OF 5TH STREET AND PURL STREET.
ELEVATION=800.38 (NAVD 1988)

Topographic Survey Symbols Legend

MANHOLE, CLEAN OUT, ROUND INLET, SQUARE INLET, CURB-CAST INLET, DOWN SPOUT, MONITORING WELL, WELL, WATER VALVE, HANDICAP STRIPING, HANDICAP ACCESS RAMP, SOIL BORING, CONIFEROUS TREE, DECIDUOUS TREE, FORESIGHT CONTROL, P.K. NAIL FOUND, IRON PIN FOUND, RIGHT-OF-WAY MARKER, SECTION CORNER, BENCH MARK, SIGN, EXISTING FINISH FLOOR, GUY ANCHOR, PARKING BLOCK, ELECTRIC BOX, ELECTRIC PANEL, MAIL BOX, AIR CONDITIONING UNIT, SHRUB, BOULDER, BOLLARD, YARD LIGHT, POST, POST INDICATOR VALVE, FIRE HYDRANT, YARD HYDRANT, GAS METER, GAS VALVE, GAS PUMP, POWER POLE, ELECTRIC METER, WATER METER, CABLE TV PEDESTAL, TELEPHONE PEDESTAL, FLAG POLE, LIGHT POLE, WOODED AREAS, UNDERGROUND FIBER OPTIC CABLE, WATER LINE, STORM SEWER LINE, SANITARY SEWER LINE, OVERHEAD TELEPHONE, OVERHEAD ELECTRIC, OVERHEAD UTILITY, UNDERGROUND ELECTRIC, UNDERGROUND TELEPHONE, UNDERGROUND GAS LINE

Topographic Survey South

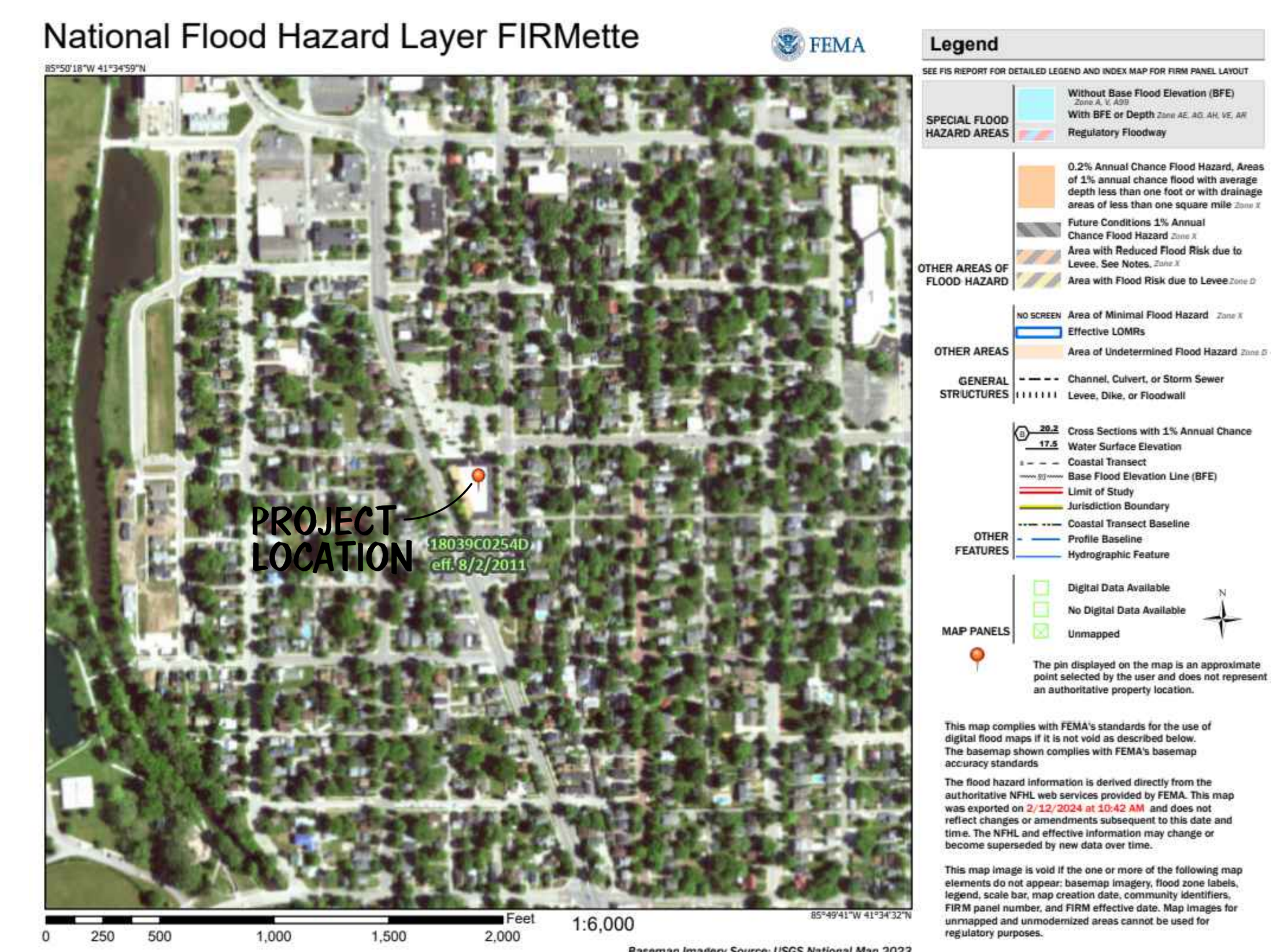
SCALE: 1" = 20'
NORTH



Site Location Map

SCALE: N.T.S.
NORTH

National Flood Hazard Layer FIRMette



Topographic Survey Positional Accuracy Standards

Based on the National Society of Professional Surveyors Model Standards for Topographic Surveys

Item	Vertical Accuracy Tolerance (Feet)	Horizontal Accuracy Tolerance (Feet)
Contour Line (1 Foot Interval)	0.65' plus or minus	1' plus or minus
Contour Line (5 Foot Interval)	3.20' plus or minus	4' plus or minus
Contour Line (10 Foot Interval)	6.50' plus or minus	8' plus or minus
Finish Floor Elevations	0.05' plus or minus	1' plus or minus
Spot Paving Elevations	0.05' plus or minus	1' plus or minus
Spot Ground Elevations	0.20' plus or minus	2' plus or minus
Sewer Invert Elevations	0.05' plus or minus	1' plus or minus
Well Defined Planimetric Features	0.10' plus or minus	1' plus or minus

Positional Accuracy is given at the 95% confidence interval level

General Notes:

1. THE LOCATION AND DIMENSIONS OF ALL BUILDING STRUCTURES ON THE FACE OF THIS SURVEY (IF APPLICABLE) ARE NOT INTENDED FOR STRUCTURAL DESIGN.
2. UTILITIES DEPICTED ON THE WITHIN PLAT OF SURVEY WERE LOCATED FROM ABOVE-GROUND PHYSICAL EVIDENCE AND APPURTENANCES. NO UTILITY LOCATION SERVICE WAS REQUESTED FOR THIS SURVEY.

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3. THE IDENTIFICATION AND DELINEATION OF WETLANDS WERE NOT A PART OF THE SURVEYING SERVICES PROVIDED. FEDERAL AND STATE LEGISLATION HAS DEFINED AND ESTABLISHED RESTRICTIONS FOR THE PROTECTION OF WETLANDS. THE PRESENCE OF WETLANDS ON OR NEAR YOUR PROPERTY WILL LIMIT OR RESTRICT THE USE AND IMPROVEMENT OF YOUR PROPERTY. YOU SHOULD CONSULT WITH YOUR STATE ENVIRONMENTAL PROTECTION AGENCY FOR A MORE DETAILED EXPLANATION ON IDENTIFYING WETLANDS AND LAWS MEANT TO ENSURE THEIR PROTECTION.
4. ELEVATIONS ON THIS SURVEY ARE BASED UPON THE NORTH AMERICAN VERTICAL DATUM 1988.
5. THIS DRAWING IS NOT INTENDED TO BE PRESENTED AS A TRACEMENT OR ORIGINAL BOUNDARY SURVEY, A ROUTE SURVEY, OR A SURVEYOR LOCATION REPORT

Professional Surveyor's Certification

THE UNDERSIGNED LAND SURVEYOR, REGISTERED UNDER THE LAWS OF THE STATE OF INDIANA, HEREBY CERTIFIES THAT HE HAS CONDUCTED THIS TOPOGRAPHICAL AND UTILITY SURVEY, UNDER HIS DIRECT SUPERVISION.

COMMISSION NUMBER: 233695
CLIENT: RATIO ARCHITECTS
DATES OF FIELD WORK: FEBRUARY 6TH, 2024
FIELD WORK COMPLETED: FEBRUARY 6TH, 2024

IN WITNESS WHEREOF, I HEREUNTO PLACE MAY HAND AND SEAL THIS 15TH DAY OF JANUARY, 2024.

REVISION DATE: JULY 22ND, 2024

TODD R. BAUER REGISTERED No. 29800007 STATE OF INDIANA PROFESSIONAL SURVEYOR

Todd R. Bauer, PS No. 29800007
todd@4site.biz

ForeSight Consulting, LLC
Professional Engineers & Surveyors
1910 St. Joe Center Road, Suite #61
Fort Wayne, Indiana 46825
260.484.9900 phone
260.484.9980 fax
www.4site.biz
EXPERIENCE. INNOVATION. RESULTS.

Performed for:

SITE TOPOGRAPHIC SURVEY FOR:

Goshen Public Library

601 South 5th Street, Goshen, IN 46526

Drawing Revisions

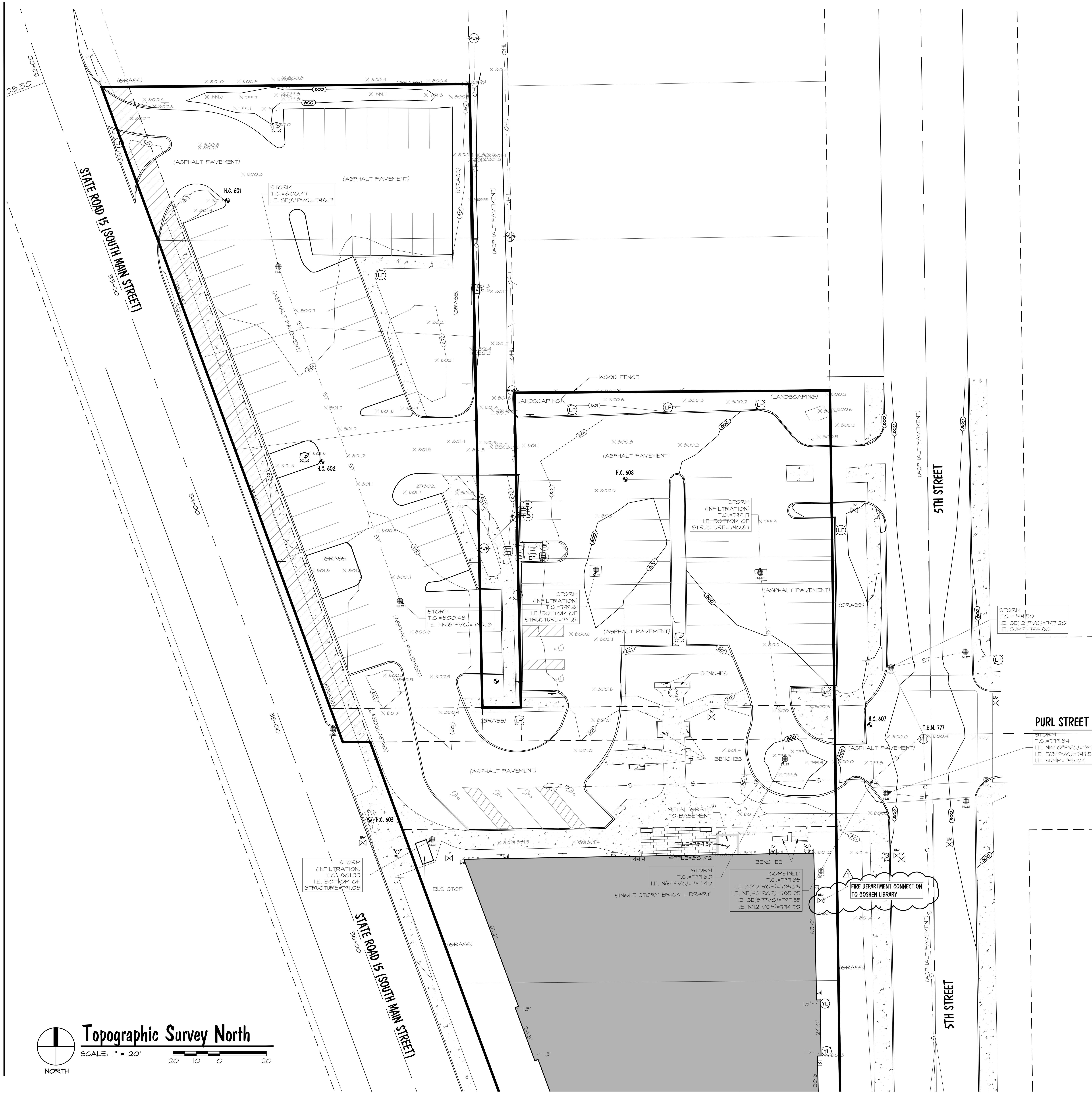
Addendum 1 - 07-24-2024

Commission Number
233695

Date
March 18th, 2024

Title

Sheet Number
S2.1
Sheet 1 of 2



Horizontal and Vertical Control

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TEMPORARY ONSITE BENCHMARK #777 (T.B.M. #777)
THE NORTH RIM OF AN EXISTING COMBINED SEWER MANHOLE LOCATED NEAR THE CENTER OF THE INTERSECTION OF 5TH STREET AND PURL STREET.
ELEVATION=800.38 (NAVD 1988)

Topographic Survey Symbols Legend

MANHOLE	FORESIGHT CONTROL	SHRUB	CABLE TV PEDESTAL
CLEAN OUT	P.K. NAIL FOUND	BOULDER	TELEPHONE PEDESTAL
ROUND INLET	IRON PIN FOUND	BOLLARD	FLAG POLE
SQUARE INLET	RIGHT-OF-WAY MARKER	YARD LIGHT	LIGHT POLE
CURB-CAST INLET	SECTION CORNER	POST	WOODED AREAS
DOWN SPOUT	BENCH MARK	POST INDICATOR VALVE	—FOC— UNDERGROUND FIBER OPTIC CABLE
MONITORING WELL	SIGN	FIRE HYDRANT	— W — WATER LINE
WELL	EXISTING FINISH FLOOR	YARD HYDRANT	— ST — STORM SEWER LINE
WATER VALVE	GUY ANCHOR	GAS METER	— S — SANITARY SEWER LINE
HANDICAP STRIPING	PARKING BLOCK	GAS VALVE	—OHT— OVERHEAD TELEPHONE
HANDICAP ACCESS RAMP	ELECTRIC BOX	GAS PUMP	—OHE— OVERHEAD ELECTRIC
SOIL BORING	ELECTRIC PANEL	POWER POLE	—OHU— OVERHEAD UTILITY
CONIFEROUS TREE	MAIL BOX	ELECTRIC METER	— UE — UNDERGROUND ELECTRIC
DECIDUOUS TREE	AIR CONDITIONING UNIT	WATER METER	— UT — UNDERGROUND TELEPHONE
			— GAS — UNDERGROUND GAS LINE

Topographic Survey Positional Accuracy Standards

Based on the National Society of Professional Surveyors Model Standards for Topographic Surveys

Item	Vertical Accuracy Tolerance (Feet)	Horizontal Accuracy Tolerance (Feet)
Contour Line (1 Foot Interval)	0.65' plus or minus	1' plus or minus
Contour Line (5 Foot Interval)	3.20' plus or minus	4' plus or minus
Contour Line (10 Foot Interval)	6.50' plus or minus	8' plus or minus
Finish Floor Elevations	0.05' plus or minus	1' plus or minus
Spot Paving Elevations	0.05' plus or minus	1' plus or minus
Spot Ground Elevations	0.20' plus or minus	2' plus or minus
Sewer Invert Elevations	0.05' plus or minus	1' plus or minus
Well Defined Planimetric Features	0.10' plus or minus	1' plus or minus

Positional Accuracy is given at the 95% confidence interval level

General Notes:

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Drawing Revisions

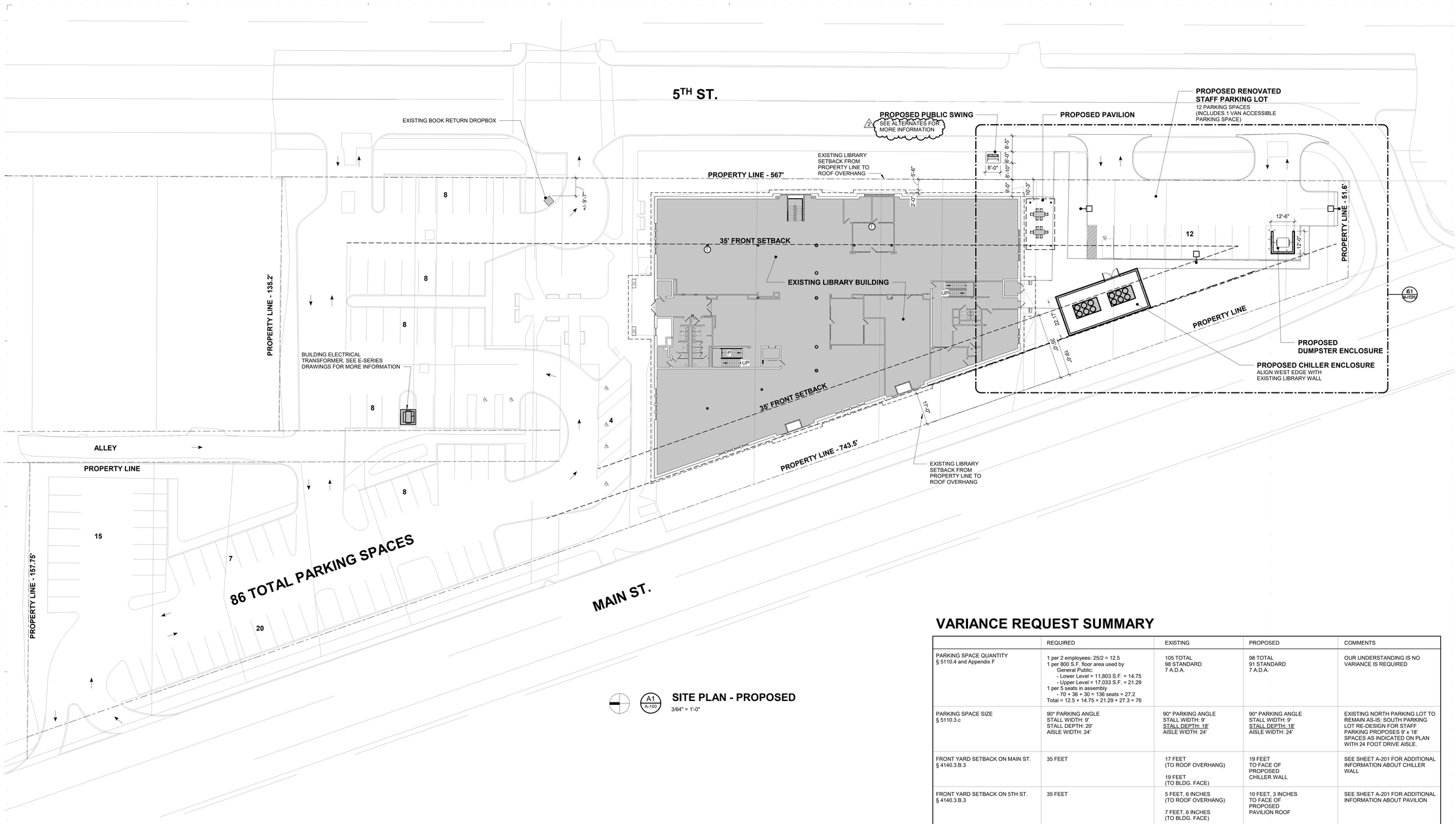
1 Addendum 1 - 07-24-2024

Commission Number
233695

Date
March 18th, 2024

Title

Sheet Number
S2.2
Sheet 2 of 2



A1 / A-100 **SITE PLAN - PROPOSED**

3/64" = 1'-0"

VARIANCE REQUEST SUMMARY

	REQUIRED	EXISTING	PROPOSED	COMMENTS
PARKING SPACE QUANTITY § 5110.4 and Appendix F	1 per 2 employees: 25/2 = 12.5 1 per 800 S.F. floor area used by General Public: - Lower Level = 11,803 S.F. = 14.75 - Upper Level = 17,033 S.F. = 21.29 1 per 5 seats in assembly - 70 + 36 + 30 = 136 seats = 27.2 Total = 12.5 + 14.75 + 21.29 + 27.3 = 76	105 TOTAL 98 STANDARD 7 A.D.A.	98 TOTAL 91 STANDARD 7 A.D.A.	OUR UNDERSTANDING IS NO VARIANCE IS REQUIRED
PARKING SPACE SIZE § 5110.3.c	90° PARKING ANGLE STALL WIDTH: 9' STALL DEPTH: 20' AISLE WIDTH: 24'	90° PARKING ANGLE STALL WIDTH: 9' STALL DEPTH: 18' AISLE WIDTH: 24'	90° PARKING ANGLE STALL WIDTH: 9' STALL DEPTH: 18' AISLE WIDTH: 24'	EXISTING NORTH PARKING LOT TO REMAIN AS-IS; SOUTH PARKING LOT RE-DESIGN FOR STAFF PARKING PROPOSES 9' x 18' SPACES AS INDICATED ON PLAN WITH 24 FOOT DRIVE AISLE.
FRONT YARD SETBACK ON MAIN ST. § 4140.3.B.3	35 FEET	17 FEET (TO ROOF OVERHANG) 19 FEET (TO BLDG. FACE)	19 FEET TO FACE OF PROPOSED CHILLER WALL	SEE SHEET A-201 FOR ADDITIONAL INFORMATION ABOUT CHILLER WALL
FRONT YARD SETBACK ON 5TH ST. § 4140.3.B.3	35 FEET	5 FEET, 6 INCHES (TO ROOF OVERHANG) 7 FEET, 6 INCHES (TO BLDG. FACE)	10 FEET, 3 INCHES TO FACE OF PROPOSED PAVILION ROOF	SEE SHEET A-201 FOR ADDITIONAL INFORMATION ABOUT PAVILION
BUILDING COVERAGE § 4140.4	MAX. 35% COVERAGE	22% SITE AREA = 103,000 S.F. BUILDING AREA = 22,690 S.F.	23.4% SITE AREA = 103,000 S.F. BUILDING AREA = 24,142 S.F.	NEW AREA INCLUDES PAVILION AND CHILLER ENCLOSURE
FENCE HEIGHT IN FRONT YARD § 5130.B.1 [TRASH FENCE ENCLOSURE]	MAX. 4 FOOT HEIGHT	N/A (NO FENCE)	8 FEET	INTENT TO DEMOLISH EXISTING BRICK MASONRY CHILLER ENCLOSURE FENCE AND BUILD NEW BRICK MASONRY CHILLER ENCLOSURE
SIGN AREA § 5100.2.A.2	MAX. 60 SQUARE FEET WHEN LOT WIDTH EXCEEDS 200 FEET	32 SQUARE FEET	PROPOSED: 57.7 S.F. FOR FREESTANDING SIGN 32 S.F. FOR WALL MOUNT SIGN TOTAL = 89.7 S.F.	INTENT TO DEMOLISH EXISTING BRICK MASONRY CHILLER ENCLOSURE FENCE AND BUILD NEW BRICK MASONRY CHILLER ENCLOSURE

GOSHEN PUBLIC LIBRARY

601 S. 5th Street
Goshen, Indiana
46526

Owner
Goshen Public Library
601 S. 5th St.
Goshen, IN 46526
574-533-9531

Architect
RATIO
101 South Pennsylvania Street
Indianapolis, Indiana 46204
317-633-4040

Structural Engineer
CE Solutions
8770 North St. #100
Fishers, IN 46038
317-818-1912

Mechanical / Electrical Engineer
KBSO Consulting LLC
275 Veterans Wy, Suite 300
Carmel, IN 46032
317-344-8044

Civil Engineer
ForeSight Consulting, LLC
1910 St. Joe Center Rd, STE 51
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260-484-9900

Asbestos and Lead Abatement Testing Engineer
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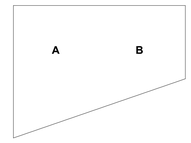
839 Mill Lake Road; Suite 400
Fort Wayne, Indiana 46845
260-483-9795



KEY PLAN

SEAL | DATE 07/24/24

WILLIAM A. BROWNE, JR. REGISTERED No. AR00034154 STATE OF INDIANA ARCHITECT

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 01	07/24/24

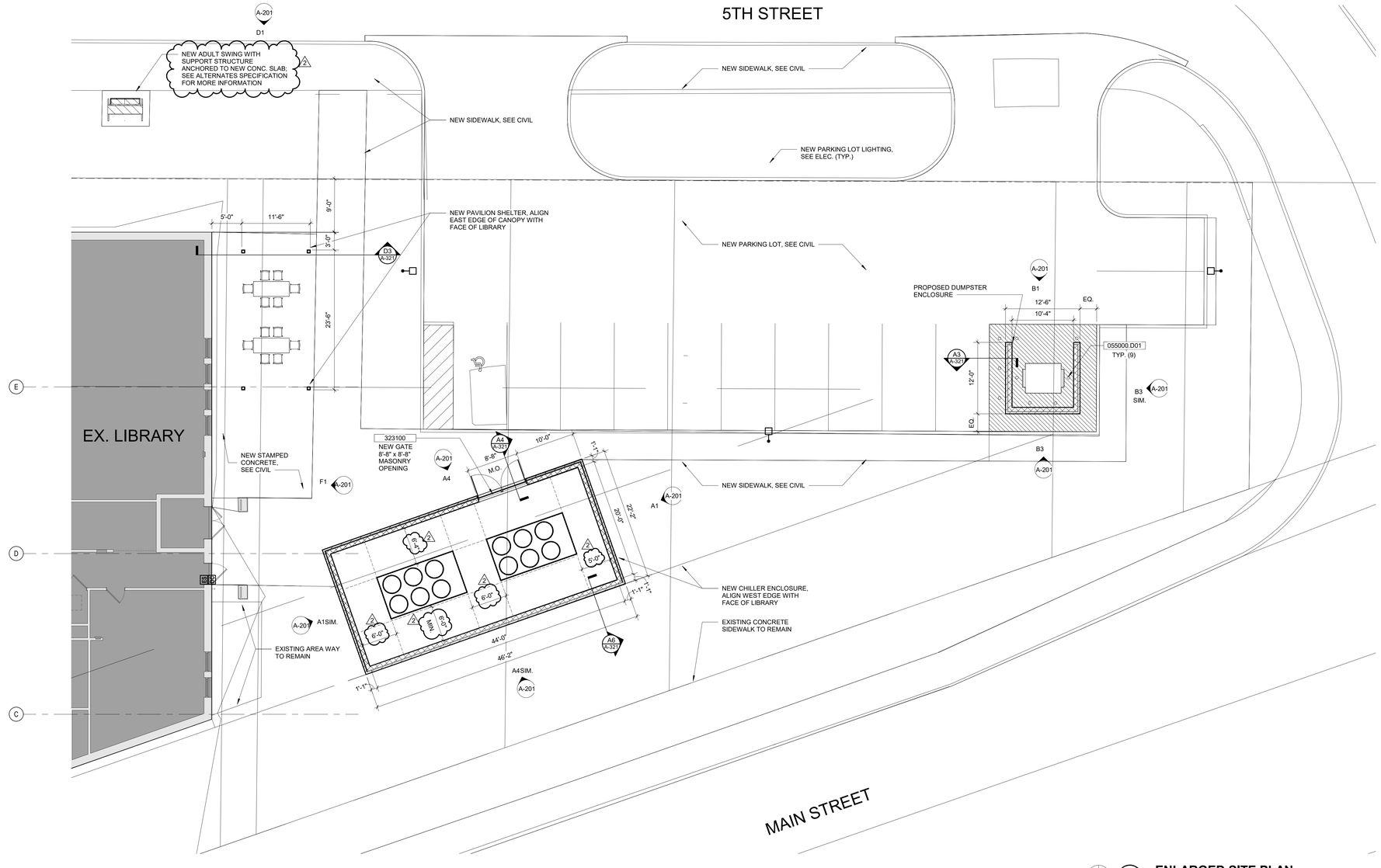
RATIO

PROJECT NO. 21730.001

SHEET TITLE
SITE PLAN

SHEET NUMBER
A-100

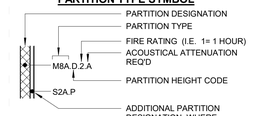
7/25/2024 9:51:29 AM



ENLARGED SITE PLAN
1/8" = 1'-0"

INTERIOR PARTITION LEGEND

PARTITION TYPE SYMBOL



NEW PARTITIONS

EXISTING PARTITIONS TO REMAIN

PARTITIONS TO BE DEMOLISHED

GOSHEN PUBLIC LIBRARY

601 S. 5th Street
Goshen, Indiana
46526

Owner
Goshen Public Library
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Goshen, IN 46526
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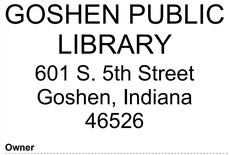

KEY PLAN

SEAL | DATE 07/24/24

WILLIAM A. BROWNE, JR. REGISTERED No. AR00034154 STATE OF INDIANA ARCHITECT

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 01	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
ENLARGED SITE PLAN

SHEET NUMBER
A-101

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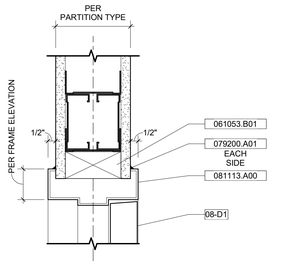
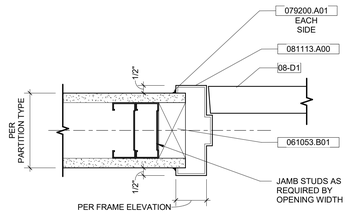


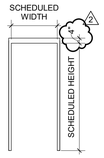
F1 A-105 **HEAD DETAIL**
3" = 1'-0"



F2 A-105 **JAMB DETAIL**
3" = 1'-0"

F

DOOR PANEL LEGEND
1/4" = 1'-0"



F1

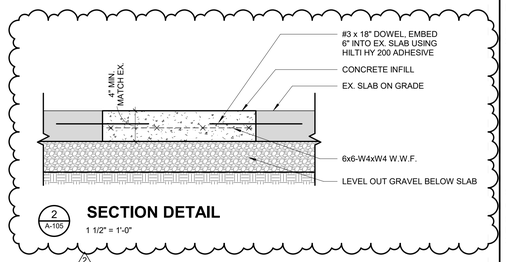
DOOR FRAME LEGEND
1/4" = 1'-0"

DOOR SCHEDULE

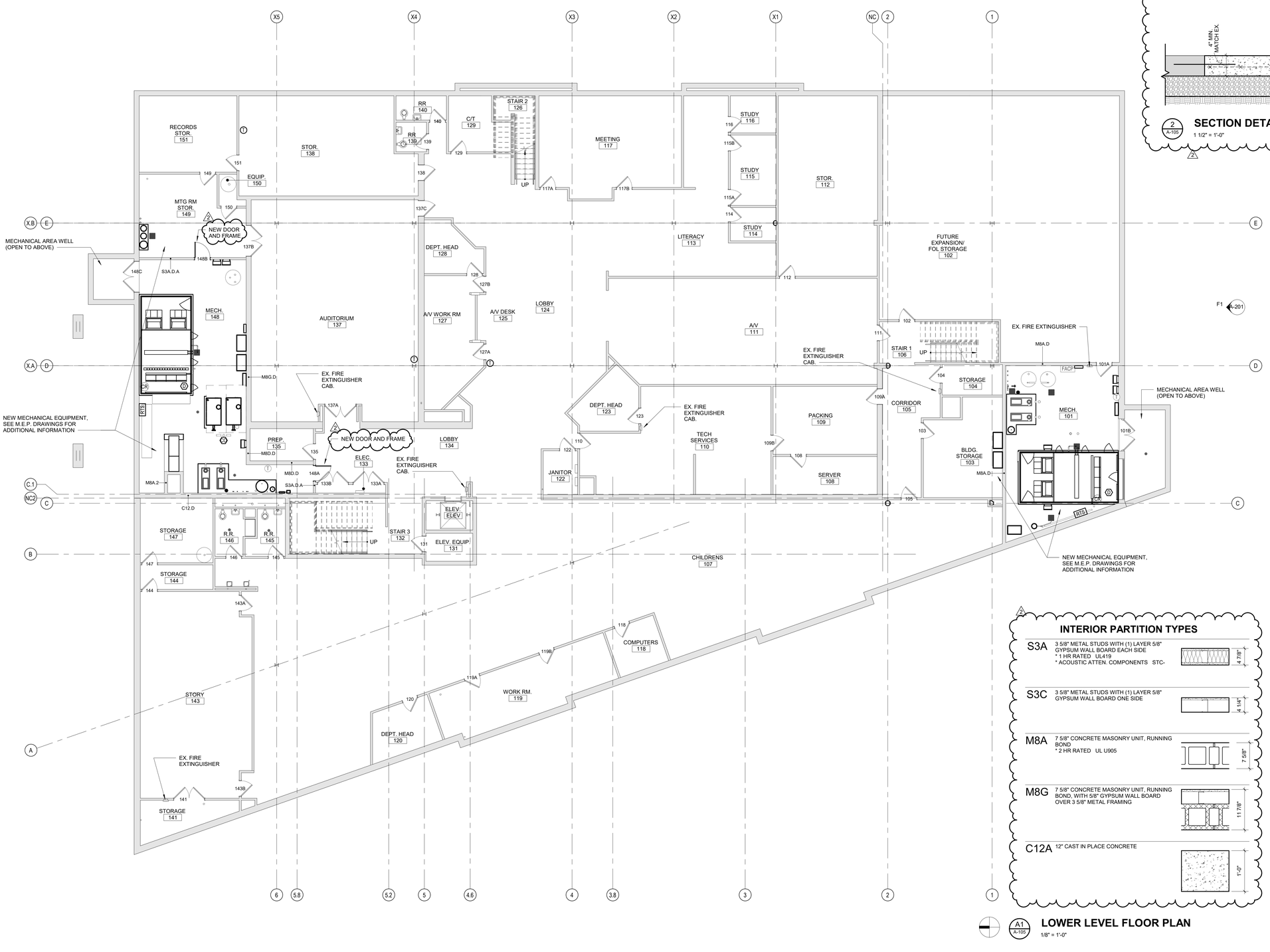
DOOR NUMBER	PAIR	DOOR SIZE W	SIZE W2	SIZE H	SIZE T	DOOR MTRL.	DOOR ELEV.	DOOR GLASS	DOOR HDWR. SET	FRAME MTRL.	FRAME ELEV.	FRAME DETAILS HEAD	FRAME DETAILS JAMB	FRAME DETAILS THRESHOLD	FIRE RATING	REMARKS
Lower Level																
148A		3'-0"		7'-0"	1 3/4"	HM	F	--	01	HM	F1	F1/A-105	F2/A-105		45 MIN.	NEW DOOR, PANIC HARDWARE, SELF CLOSING
148B		3'-0"		7'-0"	1 3/4"	HM	F	--	01	HM	F1	F1/A-105	F2/A-105		45 MIN.	NEW DOOR, PANIC HARDWARE, SELF CLOSING
Main Level																
212A		3'-6"		7'-0"	1 3/4"	HM	HG	GL-01	03	HM	F1				NR	EXISTING DOOR TO REMAIN; MODIFY DOOR HARDWARE TO ACCEPT ACCESS CONTROL
234A	Yes	3'-0"	3'-0"	7'-0"	1 3/4"	AL	FG	GL-01	02	AL	AL				NR	EXISTING DOOR TO REMAIN; MODIFY DOOR HARDWARE TO ACCEPT ACCESS CONTROL

GENERAL DOOR SCHEDULE NOTES

A. THESE GENERAL NOTES APPLY TO DOOR SCHEDULE AND DOOR DETAIL DRAWINGS.
B. UNDERCUT DOORS AS REQUIRED BY FINAL FLOOR FINISH.
C. PROVIDE SEALANT BETWEEN HOLLOW METAL FRAME PERIMETERS AND SURROUNDING WALL CONSTRUCTION UNLESS OTHERWISE INDICATED.
D. PROVIDE SEALANT BETWEEN INTERIOR AND EXTERIOR STOREFRONT FRAME PERIMETERS AND SURROUNDING WALL CONSTRUCTION UNLESS OTHERWISE INDICATED.
E. GROUT FULL NEW HOLLOW METAL DOOR FRAMES IN MASONRY WALL CONSTRUCTION.
F. SPOT GROUT NEW HOLLOW METAL DOOR FRAMES IN GYPSUM BOARD WALL CONSTRUCTION.
G. WHERE A FIRE RATING IS INDICATED ON THE DOOR SCHEDULE, HARDWARE AND DOOR ASSEMBLY COMPONENTS SHALL MEET THE REQUIREMENTS OF THAT LABEL.
H. WHERE ACOUSTICAL RATING IS INDICATED ON THE DOOR SCHEDULE, HARDWARE AND DOOR ASSEMBLY COMPONENTS SHALL MEET THE REQUIREMENTS OF THAT RATING.
I. REFER TO PROJECT MANUAL DIVISION 08 FOR HARDWARE SCHEDULE.
J. NEW CHILLER ENCLOSURE GATE TO RECEIVE DOOR HARDWARE PER SPEC SECTION 323120.



2 A-105 **SECTION DETAIL**
1 1/2" = 1'-0"

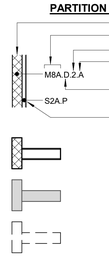


INTERIOR PARTITION TYPES

S3A	3 5/8" METAL STUDS WITH (1) LAYER 5/8" GYPSUM WALL BOARD EACH SIDE * 1 HR RATED UL419 * ACOUSTIC ATTEN. COMPONENTS STC-	4 7/8"
S3C	3 5/8" METAL STUDS WITH (1) LAYER 5/8" GYPSUM WALL BOARD ONE SIDE	4 1/4"
M8A	7 5/8" CONCRETE MASONRY UNIT, RUNNING BOND * 2 HR RATED UL U905	7 5/8"
M8G	7 5/8" CONCRETE MASONRY UNIT, RUNNING BOND, WITH 5/8" GYPSUM WALL BOARD OVER 3 5/8" METAL FRAMING	11 7/8"
C12A	12" CAST IN PLACE CONCRETE	1'-0"

INTERIOR PARTITION LEGEND

PARTITION TYPE SYMBOL



PARTITION DESIGNATION
PARTITION TYPE
FIRE RATING (I.E. 1= 1 HOUR)
ACOUSTICAL ATTENUATION REQ'D
PARTITION HEIGHT CODE
ADDITIONAL PARTITION DESIGNATION, WHERE OCCURS

NEW PARTITIONS
EXISTING PARTITIONS TO REMAIN
PARTITIONS TO BE DEMOLISHED

A1 A-105 **LOWER LEVEL FLOOR PLAN**
1/8" = 1'-0"

7/25/2024 9:51:31 AM

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SEAL | DATE 07/24/24

SHEET ISSUE

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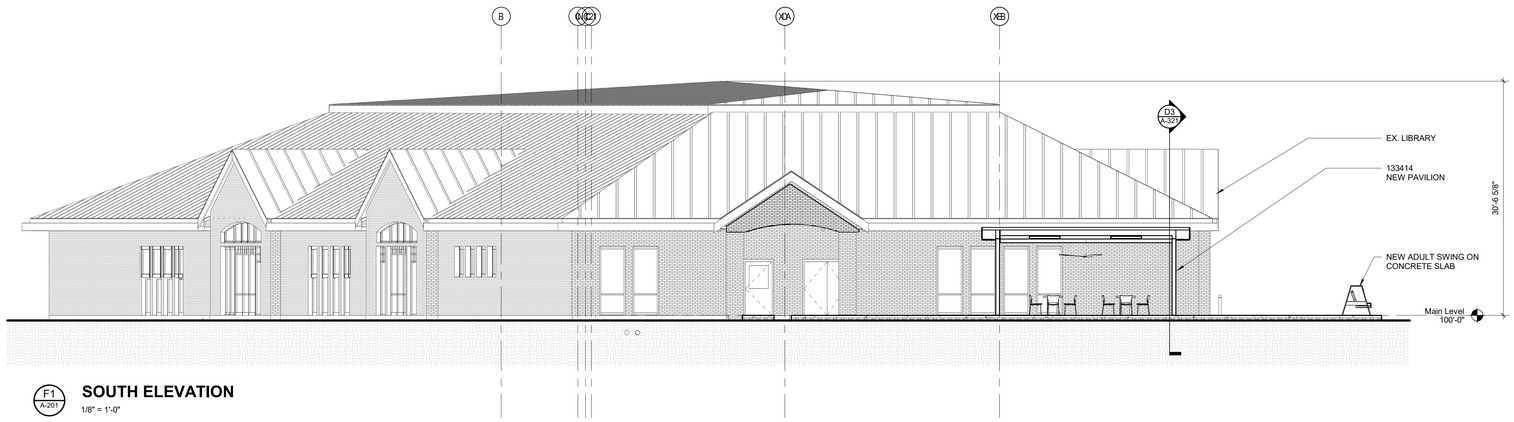
2	ADDENDUM 01	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
LOWER LEVEL FLOOR PLAN

SHEET NUMBER
A-105

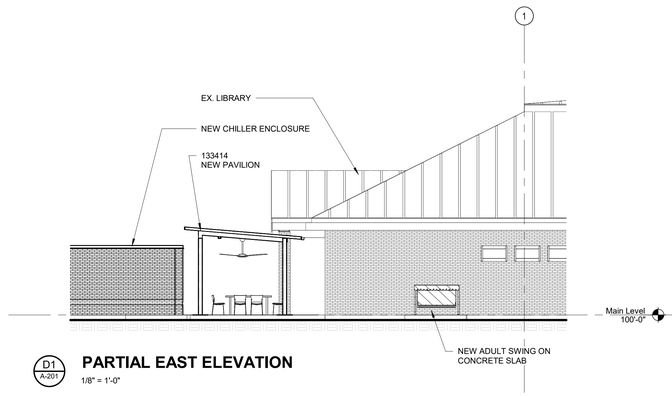


F1 A-201 **SOUTH ELEVATION**
1/8" = 1'-0"

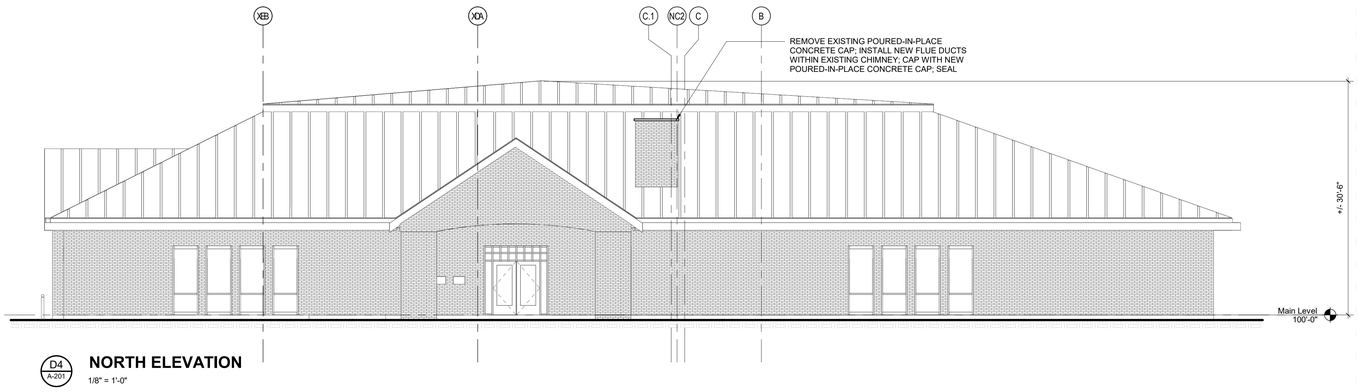
KEYNOTES (SPEC BASED)

061600.A00

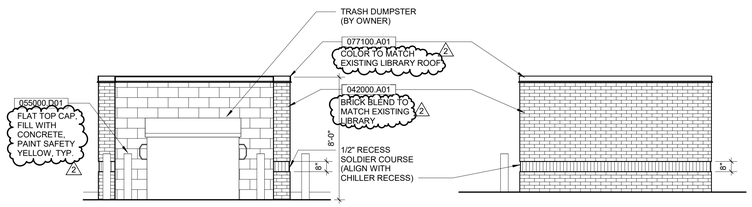
042000.A01	FACE BRICK
055000.D01	METAL BOLLARD
077100.A01	COPING, METAL, MANUFACTURED
323100	FENCES AND GATES



D1 A-201 **PARTIAL EAST ELEVATION**
1/8" = 1'-0"



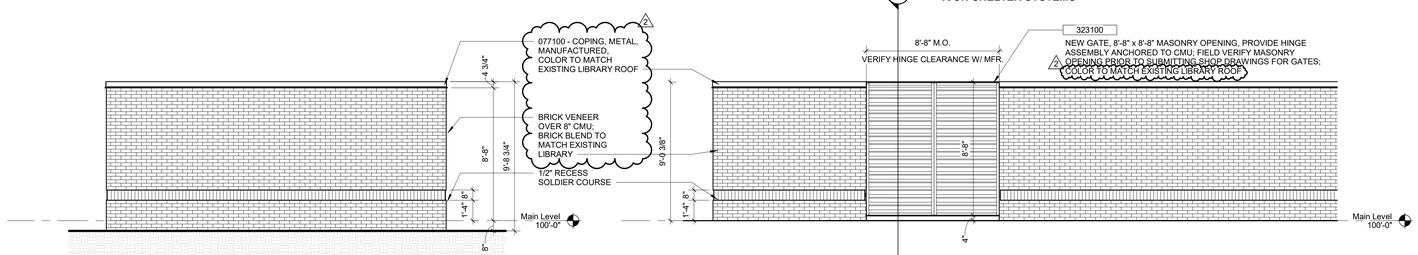
D4 A-201 **NORTH ELEVATION**
1/8" = 1'-0"



B1 A-201 **EXT ELEV-Trash Enclosure-Front**
1/4" = 1'-0"

B3 A-201 **TRASH DUMPSTER - TYPICAL BACK ELEVATION**
1/4" = 1'-0"

PAVILION PRECEDENT
ICON SHELTER SYSTEMS



A1 A-201 **CHILLER ELEVATION**
1/4" = 1'-0"

A4 A-201 **CHILLER ELEVATION**
1/4" = 1'-0"

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SEAL | DATE 07/24/24

WILLIAM A. BROWNE, JR. REGISTERED No. AR00034154 STATE OF INDIANA ARCHITECT

SHEET ISSUE

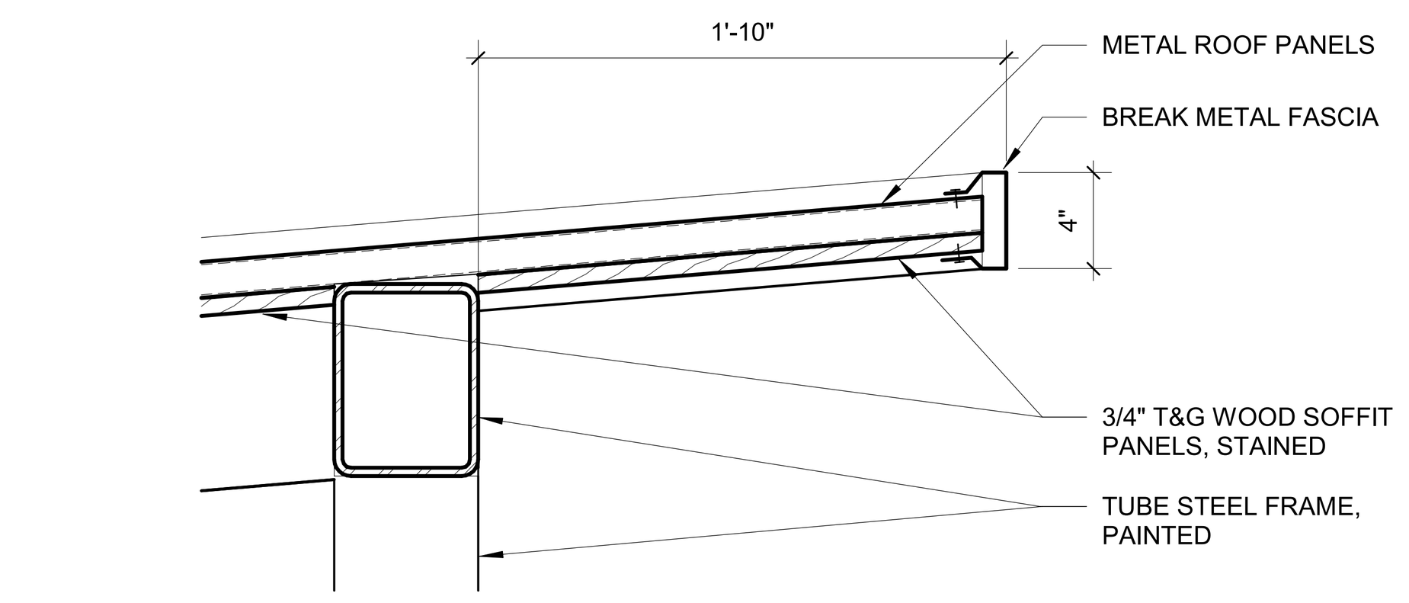
1	PERMIT SET	06/27/24
2	ADDENDUM 01	07/24/24

PROJECT NO. 21730.001

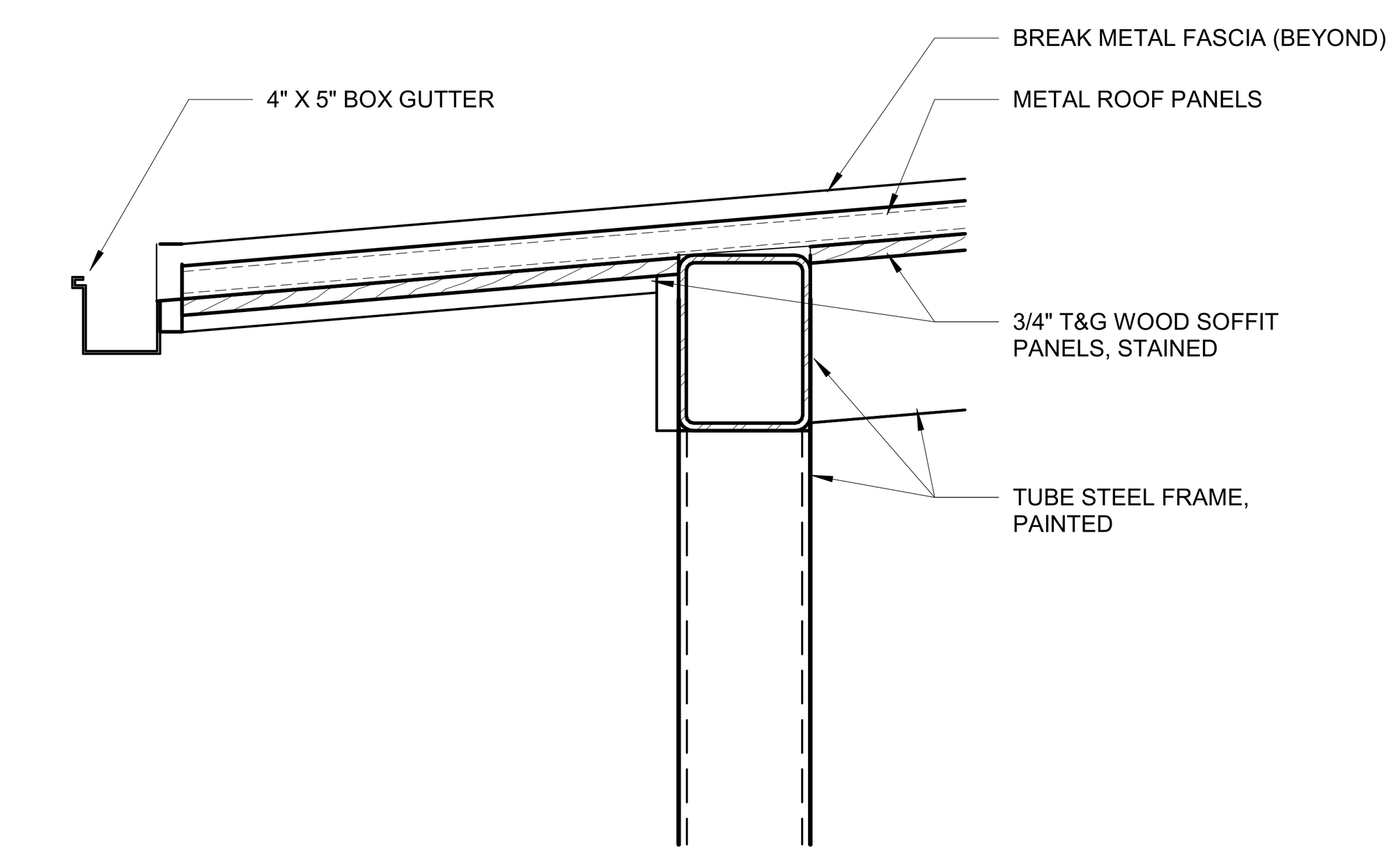
SHEET TITLE
EXTERIOR ELEVATIONS

SHEET NUMBER
A-201

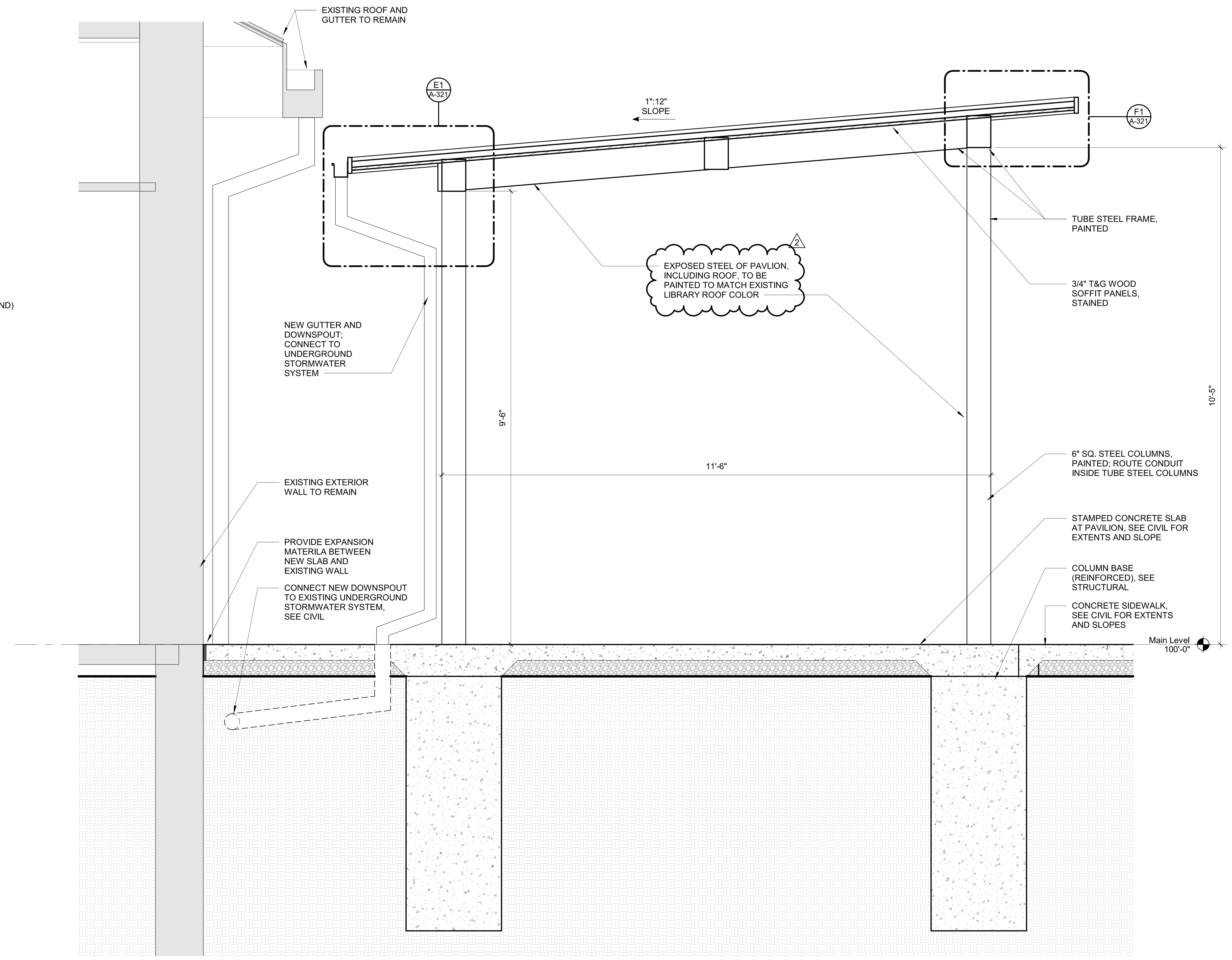
7/25/2024 9:51:43 AM



F1 A-321 **SECTION DETAIL**
1 1/2" = 1'-0"



E1 A-321 **SECTION DETAIL**
1 1/2" = 1'-0"

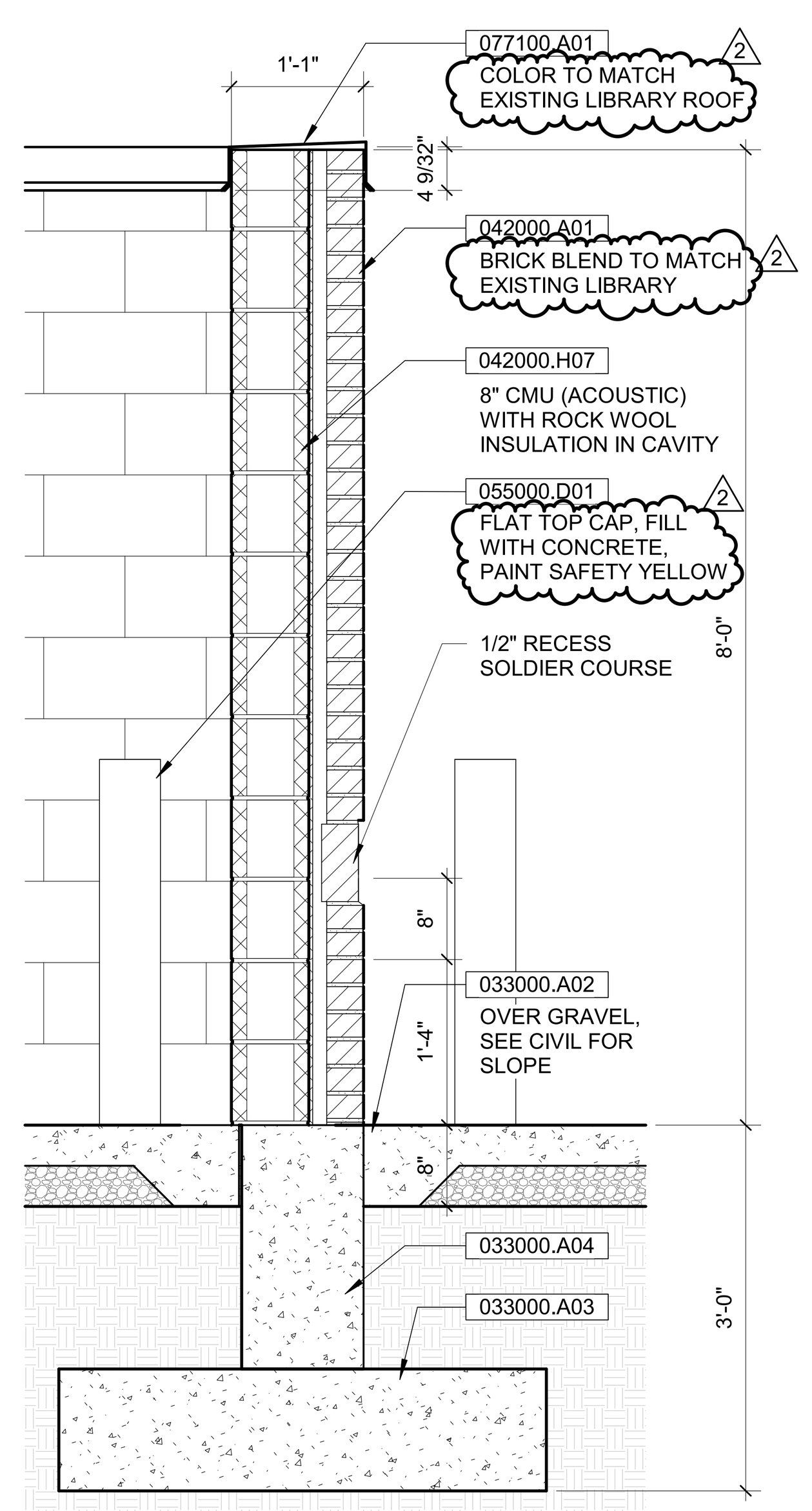


D3 A-321 **SECTION AT PAVILION**
3/4" = 1'-0"

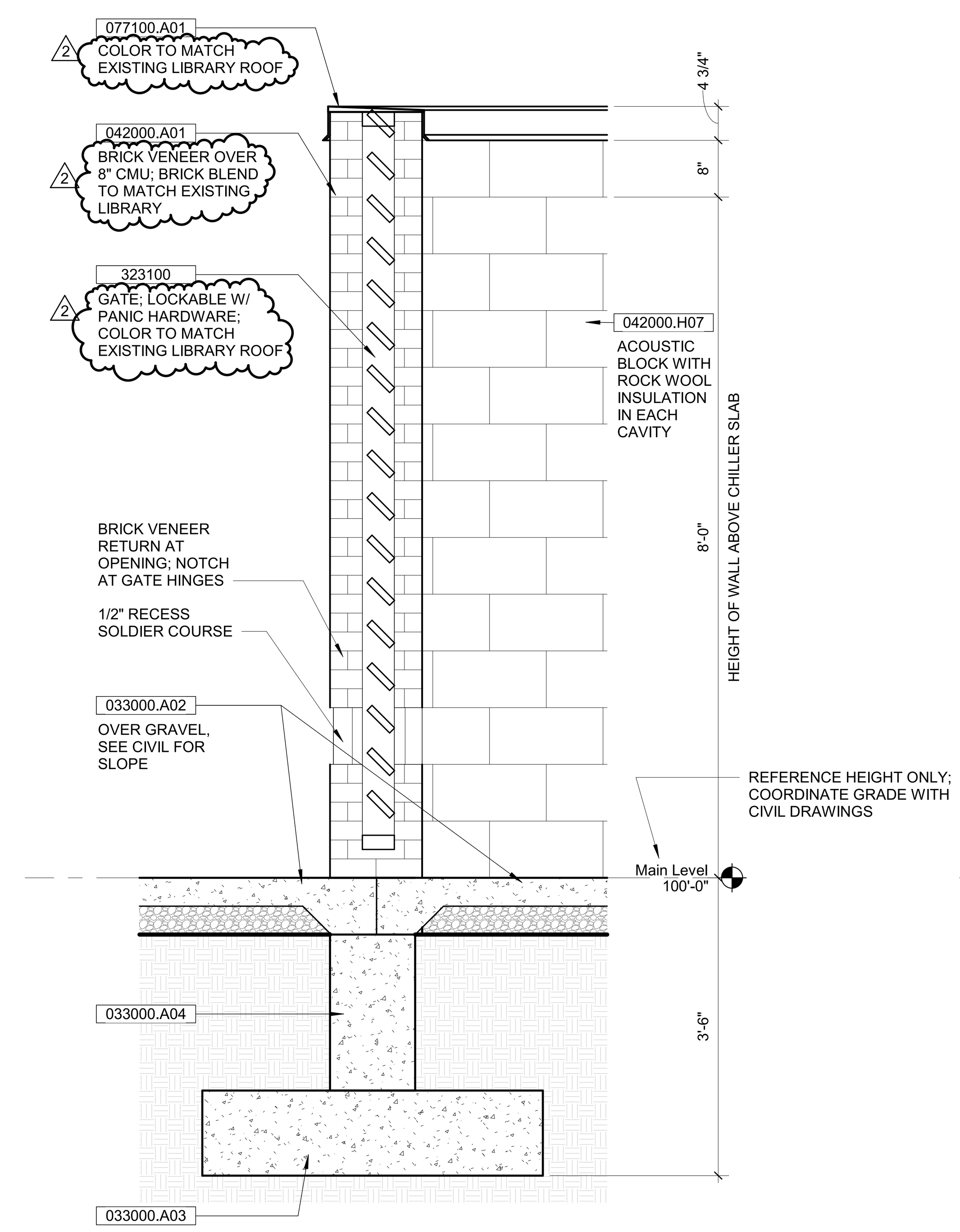
KEYNOTES (SPEC BASED)

061600.A00

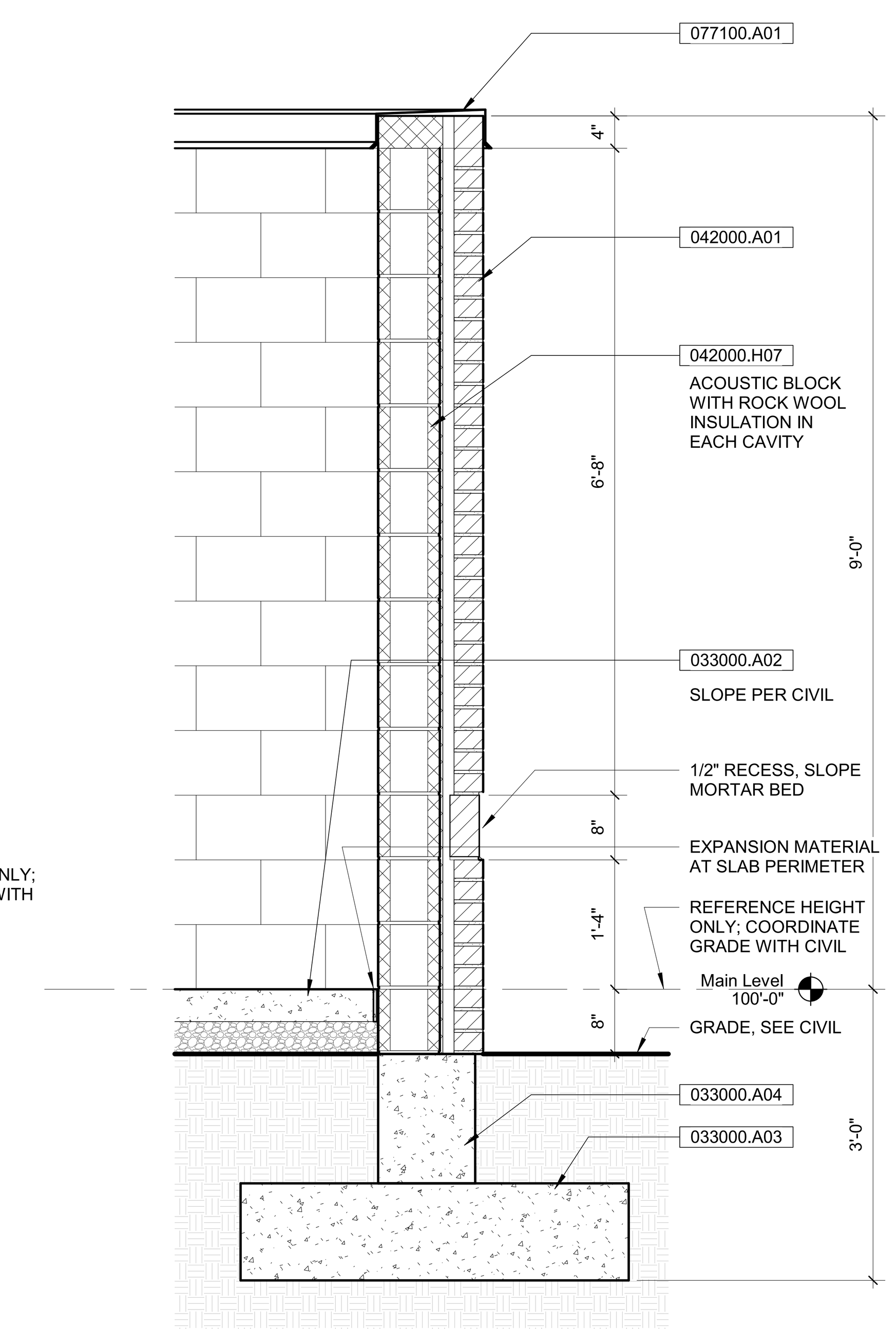
033000.A02	CAST-IN-PLACE CONCRETE SLAB
033000.A03	CAST-IN-PLACE CONCRETE FOOTING
033000.A04	CAST-IN-PLACE CONCRETE GRADE BEAM
042000.A01	FACE BRICK
042000.H07	CONCRETE MASONRY UNIT, 8"
055000.D01	METAL BOLLARD
077100.A01	COPING, METAL, MANUFACTURED
323100	FENCES AND GATES



A3 A-321 **WS- TRASH**
3/4" = 1'-0"



A4 A-321 **WALL SECTION AT CHILLER'**
3/4" = 1'-0"



A6 A-321 **WALL SECTION AT CHILLER**
3/4" = 1'-0"

7/25/2024 9:51:47 AM

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WILLIAM A. BROWNE, JR. REGISTERED No. AR00034154 STATE OF INDIANA ARCHITECT

SHEET ISSUE

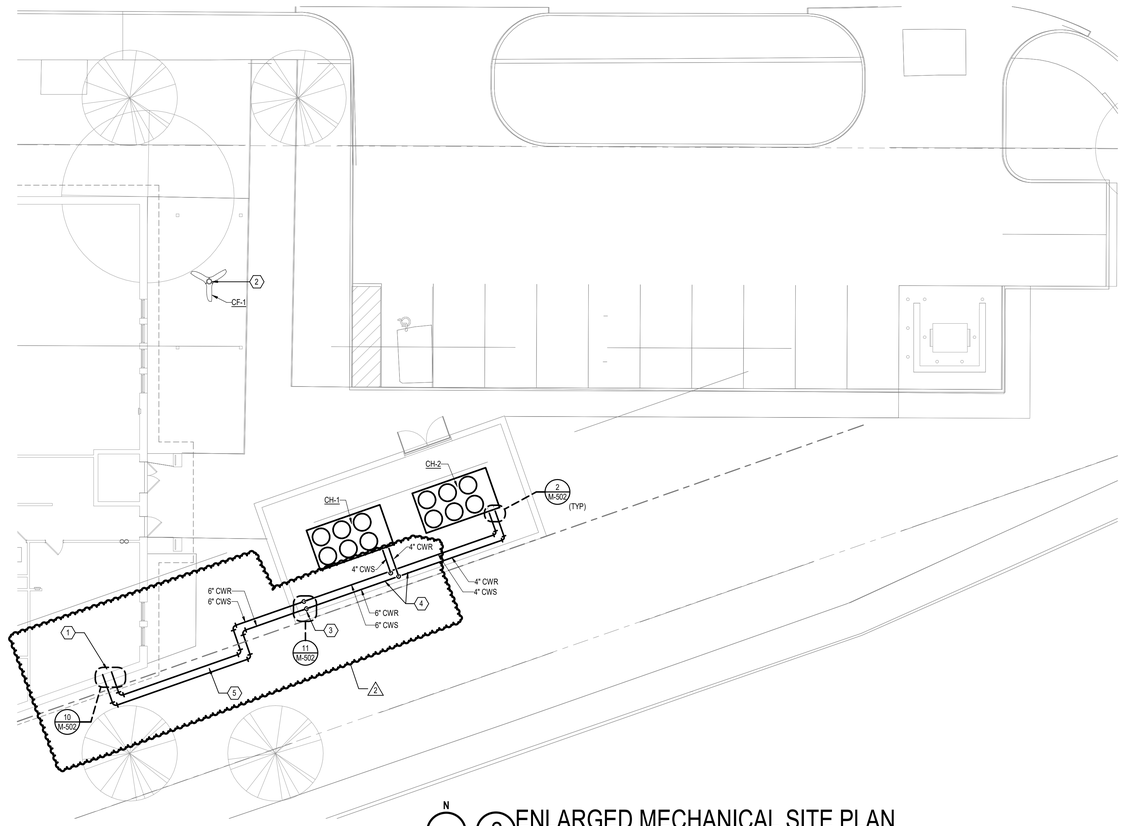
1	PERMIT SET	06/27/24
2	ADDENDUM 01	07/24/24

RATIO

PROJECT NO. 21730.001

SHEET TITLE
WALL SECTIONS

SHEET NUMBER
A-321



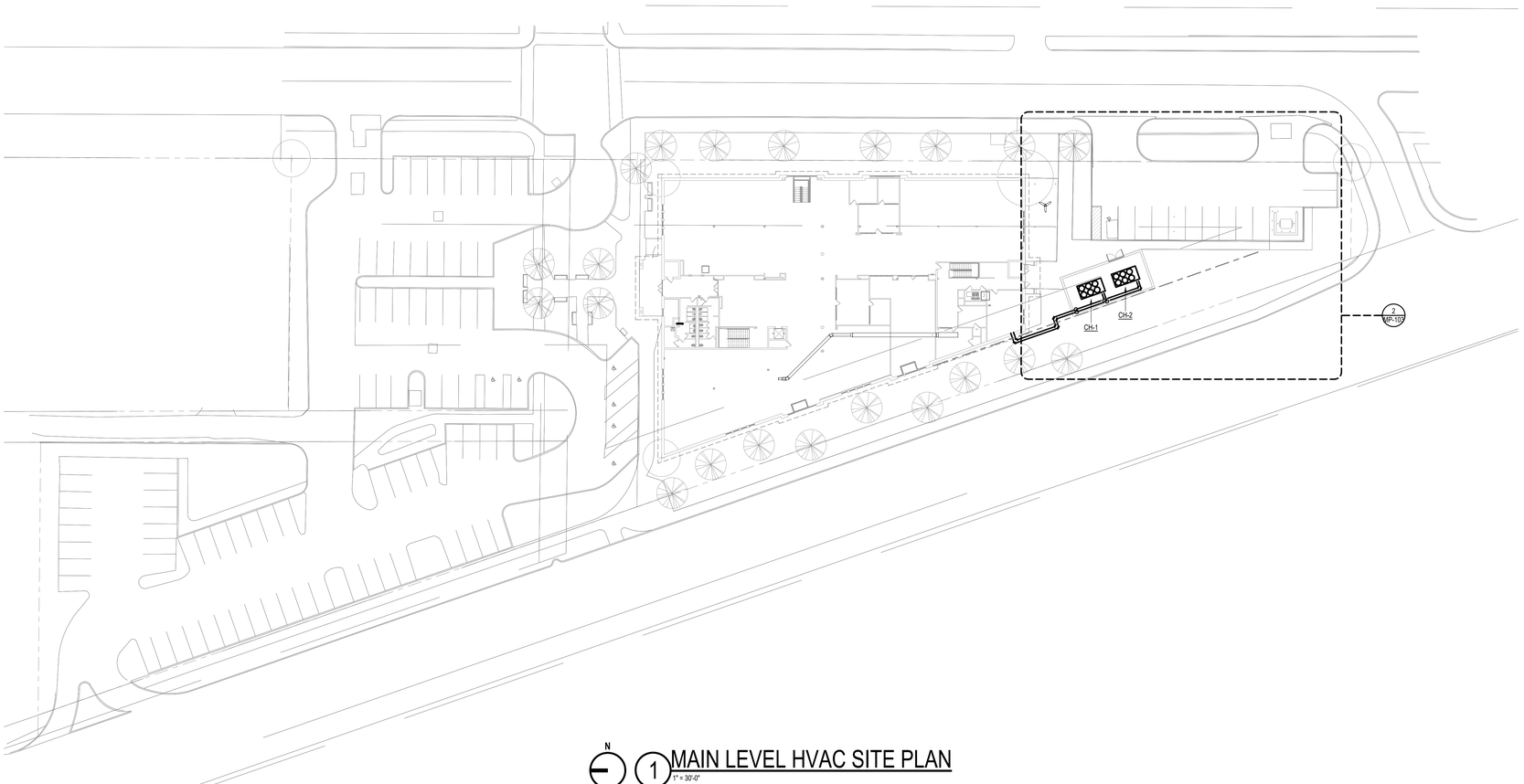
SHEET KEYNOTES

1. REFER TO DRAWING M-401 FOR CONTINUATION.
2. CEILING FAN MOUNTED TO HORIZONTAL STRUCTURAL MEMBER OF PAVILION.
3. 5" CWS&R DOWN TO UNDERGROUND.
4. PIPING TO BE SUPPORTED FROM CONCRETE SLAB NO HIGHER THAN 48" FROM SLAB AS APPROPRIATE FOR PIPING ACCESSORIES, ACCESS, MAINTENANCE, AND CONNECTIONS TO CHILLERS. BASE MOUNTED UNISTRUT/TRAPEZE PIPE SUPPORTS (WITH TWO SUPPORTS AND CROSS BRACING) ARE ACCEPTABLE AND MUST BE ATTACHED TO THE GROUND. MATERIAL TO BE STAINLESS STEEL OR HOT DIPPED GALVANIZED. ONE LEG SUPPORTS ARE NOT ACCEPTABLE. PIPING TO BE INSULATED PER 230713 AND HAVE THERMAL HANGER SHIELD INSERTS PER 230529.
5. UNDERGROUND PIPING TO BE INSTALLED WITH GILSULATE 500 XR PRODUCT OR PRE-INSULATED HDPE-JACKETED STEEL PIPING SYSTEM PER 232113.13 FROM WHERE THEY DROP UNDERGROUND UNTIL THEY ENTER THE BUILDING. INSTALL PER MANUFACTURER'S WRITTEN INSTRUCTIONS.

N

2 ENLARGED MECHANICAL SITE PLAN

3/32" = 1'-0"



N

1 MAIN LEVEL HVAC SITE PLAN

1" = 30'-0"

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SEAL | DATE 07/24/24

JOHN ALLEN WOODROUGH
REGISTERED
No. PE11300620
STATE OF INDIANA
PROFESSIONAL ENGINEER

John Allen Woodrough

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

RATIO

PROJECT NO. 21730.001

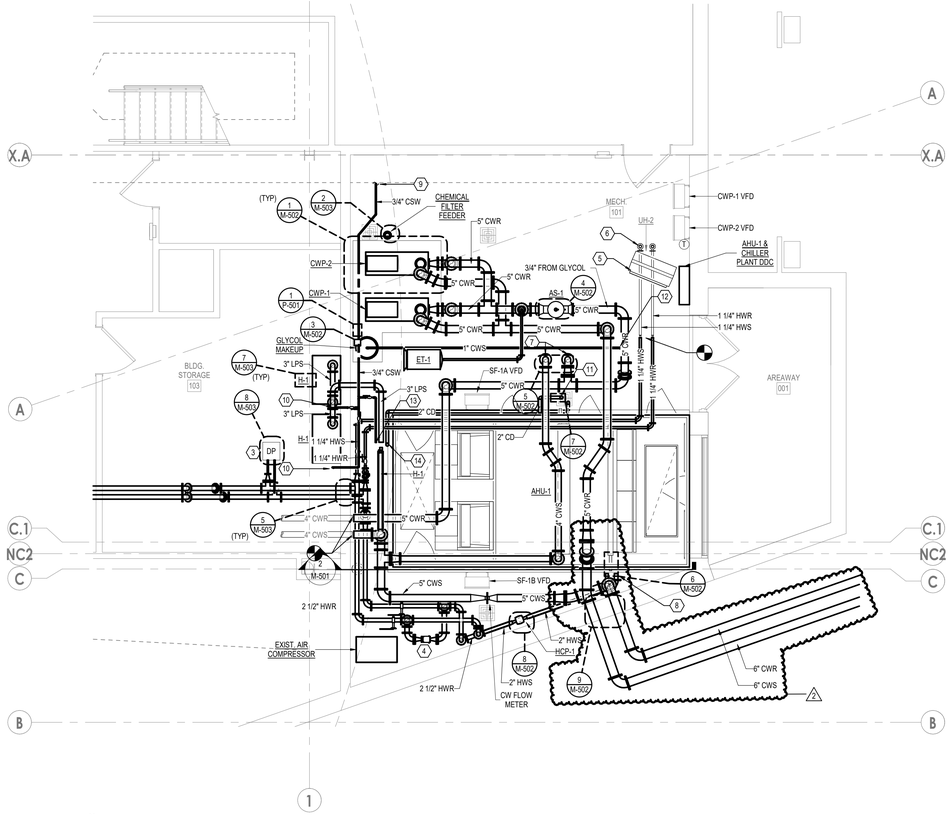
SHEET TITLE
MECHANICAL SITE PLAN

SHEET NUMBER
MP-103

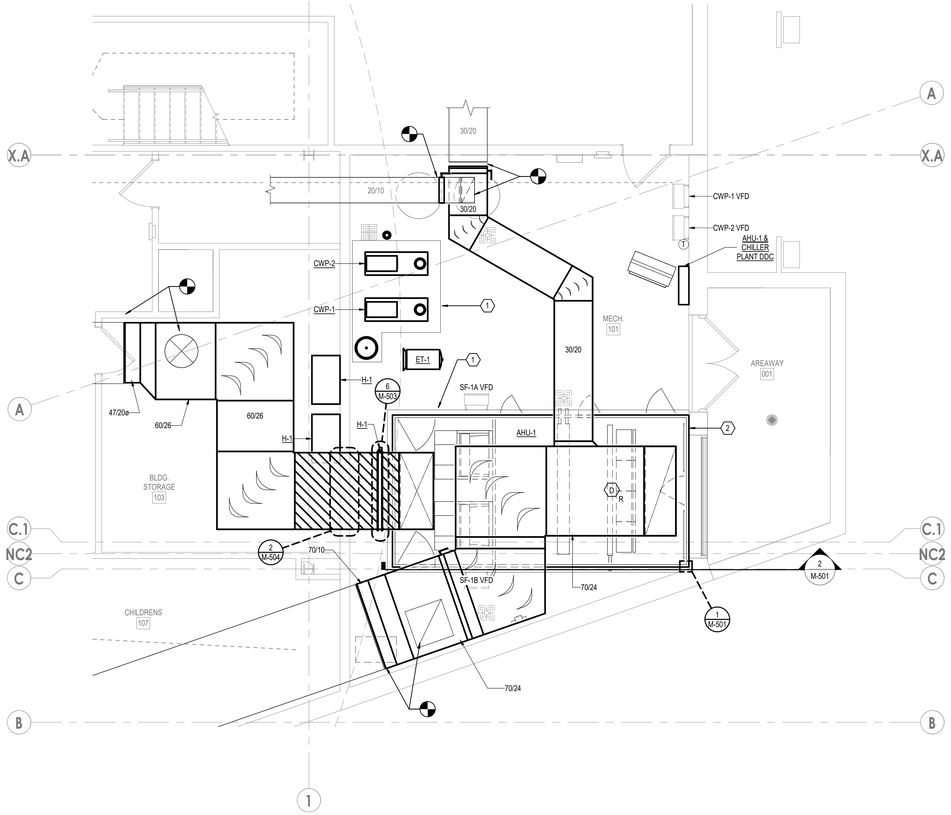
7/23/2024 11:43:25 AM

SHEET KEYNOTES

1. NEW CONCRETE EQUIPMENT PAD. REFER TO DETAIL 5 ON M-501.
2. AHU TO ABUT UP AGAINST EXISTING BASEMENT WALL TO ENCLOSE ENTIRE LOUVER SUCH THAT NO DUCTWORK IS BETWEEN AHU AND WALL/LOUVER. INSERT A 3" MIN. WIDE X ½" THICK EPDM GASKET BETWEEN AHU AND WALL AND SEAL THE CONNECTION WITH FIRE CAULK SEALANT.
3. HEATING HOT WATER SYSTEM LOOP DIFFERENTIAL PRESSURE. REFER TO SHEET M-903 FOR FURTHER INFORMATION.
4. HEATING HOT WATER SYSTEM LOOP 2-WAY MODULATING BYPASS VALVE. REFER TO SHEET M-903 FOR FURTHER INFORMATION.
5. CONNECT NEW 1-1/4" HWS&R TO EXISTING AND CONNECT TO EXISTING UNIT HEATER PER DETAIL 1 ON SHEET M-503, FLOW TO HEATER TO BE 9 GPM.
6. CONNECT NEW 3/4" HWS&R TO EXISTING HWS&R PIPING IN MECHANICAL ROOM FROM FIRST FLOOR FAN COIL AND PIPE PER DETAIL 1 ON SHEET M-503, FLOW TO FAN COIL TO BE 2 GPM.
7. 4" CWS&R DOWN TO AHU-1 COOLING COIL.
8. 2-1/2" HWS&R DOWN TO AHU-1 HEATING COIL.
9. REFER TO DRAWING P-501 FOR CONTINUATION.
10. 3/4" CSW DOWN TO HUMIDIFIER.
11. 2" CD DOWN TO FLOOR SINK. TERMINATE 1" ABOVE SINK GRATING. ASSEMBLE DRAIN WITH UNIONS.
12. 1" CWS FROM GLYCOL FEEDER TO CONNECT TO INLET SIDE OF AIR SEPARATOR PIPING.
13. 3/4" CSW TO DRAIN COOLER FOR HUMIDIFIER DRAIN.
14. 2" CD DRAIN COOLER FROM HUMIDIFIER DRAIN TO FLOOR DRAIN. ROUTE ALONG AHU BASERAIL TO FLOOR DRAIN.



N 2 LOWER LEVEL SOUTH MECHANICAL ROOM HVAC PIPING PLAN
1/4" = 1'-0"



N 1 LOWER LEVEL SOUTH MECHANICAL ROOM HVAC DUCTWORK PLAN
1/4" = 1'-0"

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JOHN ALLEN WOODROUGH REGISTERED No PE11300620 STATE OF INDIANA PROFESSIONAL ENGINEER

SHEET ISSUE

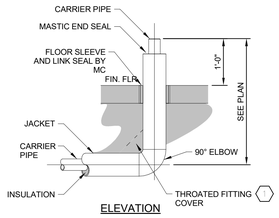
1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
SOUTH MECHANICAL ENLARGED PLANS

SHEET NUMBER
M-401

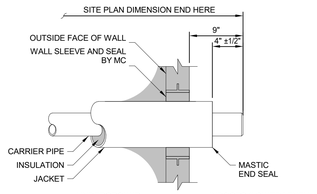
7/23/2024 11:43:21 AM



ELEVATION

NOTES:
1. ON SOME CONFIGURATIONS, A THROATED FITTING COVER IS REQUIRED.

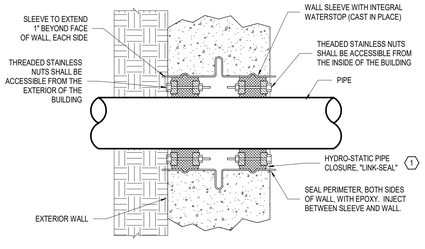
11 UNDERGROUND PIPING RISER DETAIL
NO SCALE



GENERAL NOTES :

1. FOR SYSTEMS WHICH ARE ANCHORED, A MECHANICAL COMPRESSIVE SEAL ASSEMBLY CAN BE UTILIZED FOR WATERPROOFING THE WALL PENETRATION.
2. IF EXPANSION THRU THE WALL IS ANTICIPATED, WE RECOMMEND THE FOLLOWING SEALING MECHANISM:
   2.1. WRAP THE EXTERIOR OF THE JACKET WITH AN OILED OAKUM MATERIAL FROM THE INSIDE OF THE WALL TO ABOUT HALFWAY THRU THE WALL.
   2.2. WRAP THE EXTERIOR OF THE JACKET WITH ARMAFLEX MATERIAL TO THE OUTER WALL.
   2.3. COAT THE ARMAFLEX WITH A BITUMASTIC SEALANT.

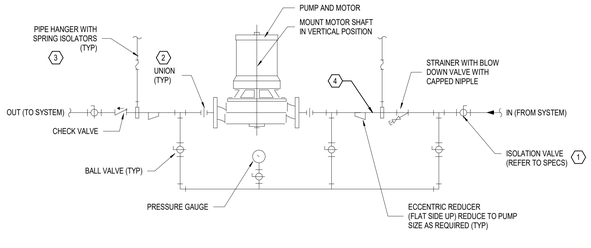
10 UNDERGROUND PIPING WALL PENETRATION DETAIL
1/2" = 1'-0"



NOTES:

1. PROVIDE PIPE SEAL ON EACH SIDE OF CENTERLINE OF WALL (2 SEALS PER SLEEVE/PIPE).

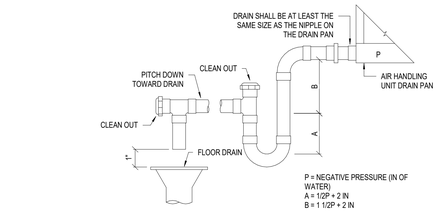
9 PENETRATION OF FOUNDATION WALL DETAIL
NO SCALE



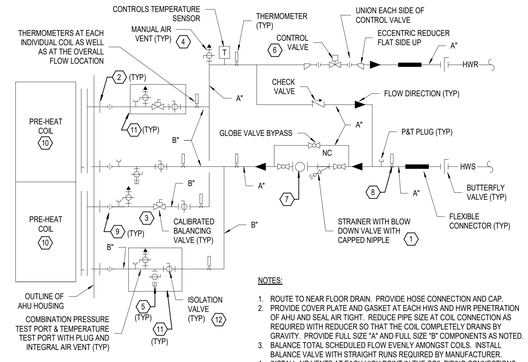
NOTES:

1. PROVIDE BUTTERFLY VALVES FOR PIPE SIZES 2-1/2" AND LARGER AND BALL VALVES FOR 2" AND SMALLER (TYP).
2. UNIONS ARE NOT REQUIRED WHEN PUMP IS CONNECTED TO PIPING WITH FLANGE CONNECTIONS.
3. SUPPORT WITH SPRING HANGERS ON EACH SIDE AS CLOSE TO PUMP AS POSSIBLE.
4. LINE SIZES PER PLANS.

8 INLINE PUMP PIPING DETAIL
NO SCALE



7 NEGATIVE PRESSURE CONDENSATE DRAIN TRAP DETAIL
NO SCALE



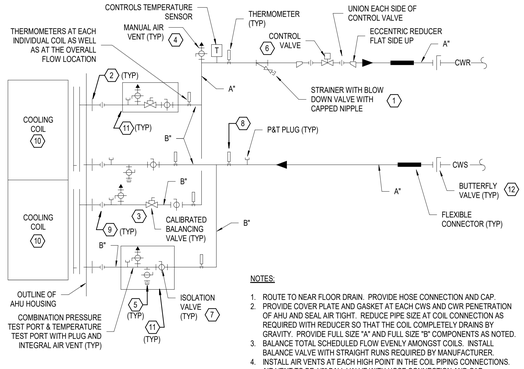
PIPE SIZES:

AHU	A	B
AHU-1	2-1/2"	2"
AHU-2	2"	2"

NOTES:

1. ROUTE TO NEAR FLOOR DRAIN. PROVIDE HOSE CONNECTION AND CAP.
2. PROVIDE COVER PLATE AND GASKET AT EACH HWS AND HWR PENETRATION OF AHU AND SEAL AIR TIGHT. REDUCE PIPE SIZE AT COIL CONNECTION AS REQUIRED WITH REDUCER SO THAT THE COIL COMPLETELY DRAINS BY GRAVITY. PROVIDE FULL SIZE "A" AND FULL SIZE "B" COMPONENTS AS NOTED.
3. BALANCE TOTAL SCHEDULED FLOW EVENLY AMONGST COILS. INSTALL BALANCE VALVE WITH STRAIGHT RUNS REQUIRED BY MANUFACTURER.
4. INSTALL AIR VENTS AT EACH HIGH POINT IN THE COIL PIPING CONNECTIONS. AIR VENT TO BE 1/2" BALL VALVE WITH HOSE CONNECTION AND CAP.
5. INSTALL 1/2" DRAIN VALVES WITH HOSE CONNECTION AND CAP AT EACH OF THE LOWEST POINTS IN THE COIL PIPING CONNECTIONS.
6. MODULATING CONTROL VALVE. INSTALL VALVE SO THAT STEM IS VERTICAL. DEMONSTRATE REMOVAL OF ACTUATOR WITH ALL PIPING INSULATED. NO STRAINER IMMEDIATELY UPSTREAM OF THIS CONTROL VALVE; SEE STRAINER AT COIL PUMP INLET.
7. REFER TO THE INLINE PUMP DETAIL FOR CHECK VALVE, ISOLATION VALVES, CALIBRATED BALANCE VALVE, PRESSURE GAUGE, ETC. REQUIRED BUT NOT ILLUSTRATED HERE.
8. ENSURE THERMOMETER WELL IS FULLY IMMERSED IN THE FLOW STREAM. TYPICAL FOR ALL THERMOMETERS AND SENSORS.
9. PROVIDE BRONZE COUPLINGS BETWEEN EACH OF THE COIL PIPING CONNECTIONS AND THE HEATING WATER PIPING TO ACT AS A DIELECTRIC. PROVIDE A UNION FOR THREADED CONNECTIONS AND PROVIDE FLANGES FOR LARGER CONNECTION SIZES.
10. VERIFY THE QUANTITY OF COILS WHEN SUBMITTING BID AND PROVIDE ADDITIONAL COIL TRIM SAME AS THIS DETAIL AS REQUIRED.
11. USE OF A COMBINATION MULTI-FUNCTION HOUSING, WHICH COMBINES ALL THE FEATURES INDICATED WITHIN THIS BOUNDARY IS ALLOWABLE FOR THIS PORTION OF THE DETAIL. PROVIDE SOLDERED OR FLANGED CONNECTIONS ON EACH END OF THE COMBINATION HOUSING.
12. PROVIDE BUTTERFLY VALVES FOR PIPE SIZES 2-1/2" AND LARGER AND BALL VALVES FOR 2" AND SMALLER (TYP).

6 AHU PRE-HEAT COIL PIPING DETAIL
NO SCALE



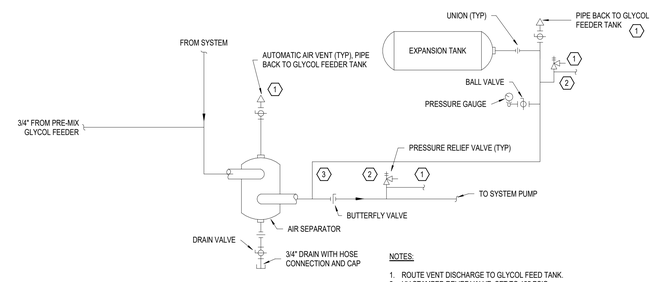
PIPE SIZES:

AHU	A	B
AHU-1	4"	3"
AHU-2	4"	3"

NOTES:

1. ROUTE TO NEAR FLOOR DRAIN. PROVIDE HOSE CONNECTION AND CAP.
2. PROVIDE COVER PLATE AND GASKET AT EACH CWS AND CWR PENETRATION OF AHU AND SEAL AIR TIGHT. REDUCE PIPE SIZE AT COIL CONNECTION AS REQUIRED WITH REDUCER SO THAT THE COIL COMPLETELY DRAINS BY GRAVITY. PROVIDE FULL SIZE "A" AND FULL SIZE "B" COMPONENTS AS NOTED.
3. BALANCE TOTAL SCHEDULED FLOW EVENLY AMONGST COILS. INSTALL BALANCE VALVE WITH STRAIGHT RUNS REQUIRED BY MANUFACTURER.
4. INSTALL AIR VENTS AT EACH HIGH POINT IN THE COIL PIPING CONNECTIONS. AIR VENT TO BE 1/2" BALL VALVE WITH HOSE CONNECTION AND CAP.
5. INSTALL 1/2" DRAIN VALVES WITH HOSE CONNECTION AND CAP AT EACH OF THE LOWEST POINTS IN THE COIL PIPING CONNECTIONS.
6. MODULATING CONTROL VALVE. INSTALL VALVE SO THAT STEM IS VERTICAL. DEMONSTRATE REMOVAL OF ACTUATOR WITH ALL PIPING INSULATED. NO STRAINER IMMEDIATELY UPSTREAM OF THIS CONTROL VALVE; SEE STRAINER AT COIL PUMP INLET.
7. PROVIDE BUTTERFLY VALVES FOR PIPE SIZES 2-1/2" AND LARGER AND BALL VALVES FOR 2" AND SMALLER (TYP).
8. ENSURE THERMOMETER WELL IS FULLY IMMERSED IN THE FLOW STREAM. TYPICAL FOR ALL THERMOMETERS AND SENSORS.
9. PROVIDE BRONZE COUPLINGS BETWEEN EACH OF THE COIL PIPING CONNECTIONS AND THE CHILLED WATER PIPING TO ACT AS A DIELECTRIC. PROVIDE A UNION FOR THREADED CONNECTIONS AND PROVIDE FLANGES FOR LARGER CONNECTION SIZES.
10. VERIFY THE QUANTITY OF COILS WHEN SUBMITTING BID AND PROVIDE ADDITIONAL COIL TRIM SAME AS THIS DETAIL AS REQUIRED.
11. USE OF A COMBINATION MULTI-FUNCTION HOUSING, WHICH COMBINES ALL THE FEATURES INDICATED WITHIN THIS BOUNDARY IS ALLOWABLE FOR THIS PORTION OF THE DETAIL. PROVIDE SOLDERED OR FLANGED CONNECTIONS ON EACH END OF THE COMBINATION HOUSING.
12. LOCATE WITH CHAIN WHEEL OPERATORS SUCH THAT VALVES AND CHAINS ARE ACCESSIBLE.

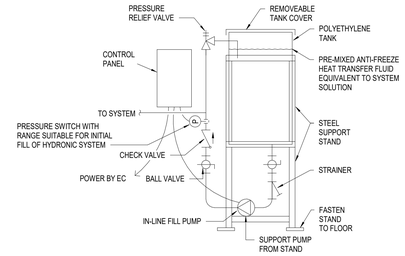
5 AHU COOLING COIL PIPING DETAIL
NO SCALE



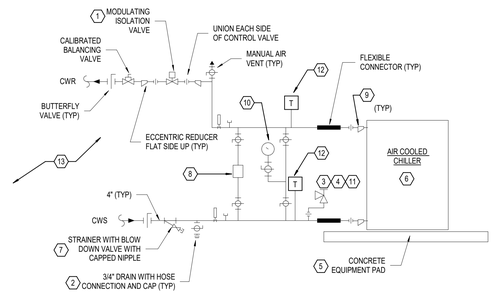
NOTES:

1. ROUTE VENT DISCHARGE TO GLYCOL FEED TANK.
2. UV STAMPED RELIEF VALVE, SET TO 125 PSIG.
3. PROVIDE ANTI-THERMOSYPHON LOOP, 12" MINIMUM DROP.

4 HORIZONTAL AIR SEPARATOR (GLYCOL) PIPING DIAGRAM
NO SCALE



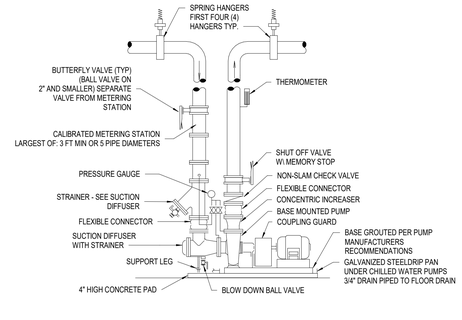
3 GLYCOL FILL SYSTEM DETAIL
NO SCALE



NOTES:

1. INSTALL MODULATING VALVE SO THAT STEM IS VERTICAL.
2. INSTALL AT LOWEST POINT IN PIPING.
3. ROUTE SRV DISCHARGE TO GROUND.
4. "UV" STAMPED WATER PRESSURE RELIEF VALVE MUST BE LOCATED WITH NO VALVE BETWEEN IT AND THE HEAT EXCHANGER. PIPE DISCHARGE DOWN TO 6" AFF. "UV" STAMPED SAFETY VALVE WITH VITON SEAT SUITABLE FOR 250ºF WITH PACKED LEVER (LIQUID SERVICE ASME SEC. VIII) AND STAINLESS SPRING SIZED FOR 40 GPM WATER (90% RATED LIQUID AT 10%). SET TO RELIEVE AT 150 PSIG.
5. AIR COOLED CHILLER MOUNTED ON CONCRETE EQUIPMENT PAD BY OTHERS, MC TO PROVIDE NEOPRENE ISOLATORS BETWEEN UNIT AND PAD.
6. FLOW SWITCH INTEGRAL TO CHILLER, FACTORY INSTALLED.
7. PROVIDE STRAINER MESH SIZE PER THE HEAT EXCHANGER MANUFACTURER'S WRITTEN REQUIREMENTS.
8. BUILDING AUTOMATION DIFFERENTIAL PRESSURE SENSOR AND VALVE MANIFOLD.
9. UNION AND REDUCER AS REQUIRED TO CONNECT TO CHILLER HEAT EXCHANGER.
10. LIQUID FILLED PRESSURE GAUGE (0-100 PSIG).
11. UNION WITH 110 PSIG PRESSURE RELIEF VALVE.
12. CHILLER CHILLED WATER ENTERING AND LEAVING TEMPERATURE SENSORS.
13. NOTE ALL COMPONENTS MUST BE INSTALLED IN ENCLOSURES RATED FOR OUTDOOR.

2 AIR COOLED CHILLER PIPING DETAIL
NO SCALE



1 BASE MOUNTED, END-SUCTION PUMP DETAIL
NO SCALE

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SEAL | DATE 07/24/24

REGISTERED No. PE11300620 STATE OF INDIANA PROFESSIONAL ENGINEER
John Allen Woodrough

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
MECHANICAL DETAILS

SHEET NUMBER
M-502

7/23/2024 11:43:22 AM

TERMINAL BOX SCHEDULE

GENERAL NOTES (APPLY TO ALL ENTRIES IN SCHEDULE):
A. DUCT RUNOUT SIZE TO TERMINAL BOX SHALL BE 2" LARGER THAN SCHEDULED INLET SIZE UNLESS NOTED OTHERWISE ON PLANS. PROVIDE TRANSITION TO INLET SIZE PER DETAIL.
B. DISCHARGE DUCT SIZE SHALL BE EQUAL TO TERMINAL BOX OUTLET SIZE UNLESS NOTED OTHERWISE ON PLANS. PROVIDE TRANSITION AS NECESSARY.
C. MAXIMUM AIRSIDE PRESSURE DROP TO BE 0.50 IN. W.G. AT HIGHEST SCHEDULED AIRFLOW, INCLUDING TERMINAL BOX AND HEATING COIL, UNLESS NOTED OTHERWISE. INCREASE SIZE OF TERMINAL BOX IF AIRSIDE PRESSURE DROP IS ABOVE MAXIMUM.
D. MAXIMUM WATERSIDE PRESSURE DROP TO BE 7 FT., UNLESS NOTED OTHERWISE.
E. SIZE HEATING COIL BASED ON HEATING MAXIMUM AIRFLOW UNLESS NOTED OTHERWISE. SUBMIT HEATING PERFORMANCE (LWT, LAT, BTU/HR., AND WATERSIDE PRESSURE DROP) AT MAXIMUM HEATING AIRFLOW AND COIL GPM SCHEDULED.
F. PROVIDE MINIMUM TWO-ROW COIL. PROVIDE ADDITIONAL COIL ROWS AS REQUIRED TO MEET SCHEDULED HEATING PERFORMANCE.
G. PIPE RUNOUT SIZE TO TERMINAL BOX COIL SHALL BE 3/4" FOR COILS WITH 0 - 3.2 GPM AND 1" FOR COILS WITH 3.3 - 7.0 GPM UNLESS NOTED OTHERWISE ON PLANS.
H. PROVIDE FACTORY CALIBRATION OF CONTROLLER MINIMUM AND MAXIMUM SETTINGS. SEE CONTROL SCHEMATICS AND SPECIFICATIONS.

NOTES:
1. N/A

TAG	CFM			UNIT INLET SIZE (IN.)	DUCT RUNOUT SIZE (IN.)	AIR DATA		HOT WATER HEATING COIL						DESIGN REFERENCE		NOTES
	COOLING MAX.	MIN.	HEATING MAX.			E.A.T. (°F)	MIN. L.A.T. (°F)	FLUID	GPM	E.W.T. (°F)	APPROX. L.W.T. (°F)	PIPE RUNOUT SIZE TO COIL (IN.)	MIN. CAPACITY (BTU/HR.)	MANUFACTURER	MODEL	
TB-1	1,800	540	980	14"	16"	55	85	WATER	4.1	130	110	1"	37899	PRICE	SDV	
TB-2	1,000	300	540	10"	12"	55	85	WATER	2.3	130	110	3/4"	17577	PRICE	SDV	
TB-3	5,400	1,620	2920	24"x16"	26"x18"	55	85	WATER	12.4	130	110	1 1/2"	95046	PRICE	SDV	
TB-4	4,600	1,380	2490	24"x16"	26"x18"	55	85	WATER	10.5	130	110	1 1/2"	81050	PRICE	SDV	
TB-5	3,000	900	1620	24"x16"	26"x18"	55	85	WATER	6.9	130	110	1 1/2"	52731	PRICE	SDV	

CEILING FAN SCHEDULE

NOTES:
1. CEILING FAN TO BE OUTDOOR RATED AND CONTAIN THE FOLLOWING OPTIONS OR FEATURES: ALUMINUM AIRFOIL BLADES, EC DIRECT DRIVE MOTOR, BLUETOOTH REMOTE, 0-10 Vdc BAS MODULE, ONBOARD TEMP/HUMIDITY AND MOTION SENSORS, STABLIZER KIT, 7" DOWNROD, FIXED WALL MOUNT BLUETOOTH REMOTE,
2. AIRFOIL BLADE FINISH AND HARDWARE COLOR TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLOR PALETTE.
3. FAN MOUNTED ON FLAT SURFACE. TOTAL FAN HEIGHT TO BE 16' OR LESS.

UNIT ID	FAN DATA			MOTOR DATA			ACCESSORIES			UNIT WEIGHT (LBS)	MANUFACTURERWITH MODEL NUMBER	NOTES
	BLADE SIZE (IN.)	DRIVE TYPE	CFM	WATTS	VOLTS	PH	LIGHT	DOWNROD	WIRELESS REMOTE			
CF-1	84	DIRECT	17000	42.3	120	1	NO	7 IN.	YES	26.00	BIG ASS FAN: HAIKU 84 IN.	1, 2, 3

VIBRATION ISOLATION AND SEISMIC RESTRAINT SCHEDULE

NOTES:

1. REFER TO VIBRATION ISOLATION SPECIFICATION SECTION FOR DEFINITION OF TYPES OF BASES, ISOLATORS, AND RESTRAINTS.
2. BASE TYPES:
   A. NO BASE, ISOLATORS ATTACHED DIRECTLY TO EQUIPMENT
   B. STRUCTURAL STEEL RAILS OR BASE
   C. CONCRETE INERTIA BASE
   D. CURB-MOUNTED BASE
3. ISOLATOR TYPES:
   1. PAD, RUBBER, OR GLASS FIBER
   2. RUBBER FLOOR ISOLATOR OR HANGER
   3. SPRING FLOOR ISOLATOR OR HANGER
   4. RESTRAINED SPRING ISOLATOR
   5. THRUST RESTRAINT
4. N/A = NOT APPLICABLE.
5. N/R = NOT REQUIRED.
6. FAN ISOLATION AND RESTRAINT BY AHU MANUFACTURER, REFER TO SPECIFICATIONS.
7. ANCHOR BOILER TO PAD PER MANUFACTURER'S WRITTEN INSTRUCTIONS AND SEISMIC CALCULATIONS.
8. FAN IS INTERALLY ISOLATED BY UNIT MANUFACTURER.

UNIT ID	LOCATION	ELEVATION FROM GRADE	BASE TYPE	ISOLATOR TYPE	MIN. STATIC DEFLECTION IN	SEISMIC RESTRAINT	NOTES
AHU-1	SOUTH MECH	-12'-0"	A	1	0.25"	NO	6
AHU-2	NORTH MECH	-12'-0"	A	1	0.25"	NO	6
SF-1A & 1B	AHU-1	-11'-4"	B	3	1.5"	NO	
SF-2A & 2B	AHU-2	-11'-4"	B	3	1.5"	NO	
B-1	MECH. ROOM	0'-4"	A	1	0.25"	NO	7
B-2	MECH. ROOM	0'-4"	A	1	0.25"	NO	7
CH-1	GRADE	0'-4"	A	1	0.25"	NO	
CH-2	GRADE	0'-4"	A	1	0.25"	NO	
HWP-1	NORTH MECH	0'-4"	C	3	0.75"	NO	
HWP-2	NORTH MECH	0'-4"	C	3	0.75"	NO	
CWP-1	SOUTH MECH	0'-4"	C	3	0.75"	NO	
CWP-2	SOUTH MECH	0'-4"	C	3	0.75"	NO	
HCP-2	NORTH MECH	7'-0"	N/A	N/R	N/A	NO	
HCP-1	SOUTH MECH	4'-0"	N/A	N/R	N/A	NO	

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SHEET ISSUE

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2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
MECHANICAL SCHEDULES

SHEET NUMBER
M-602

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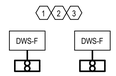
DDC POINT SCHEDULE - DW

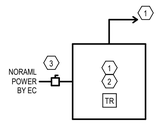
CONTROLLER POINT & TYPE	OBJECT NAME	OBJECT DESCRIPTION	UNITS	TREND	ALARM	GRAPHIC	NOTES
AI-X	DWS-F	WS-1A WATER FLOW	GPM	Yes	No	Yes	
AI-Y	DWS-F	WS-1B WATER FLOW	GPM	Yes	No	Yes	



PLAN NOTES

1. CONNECT ANALOG INPUT POINTS TO NEAREST DDC PANEL.
2. FLOW METERS PROVIDED BY TCC AND INSTALLED BY MC. REFER TO SHEET P-501 AND SPECIFICATION SECTION 230923 FOR FURTHER INFORMATION.
3. FLOW TO BE TRENDED ON BAS.

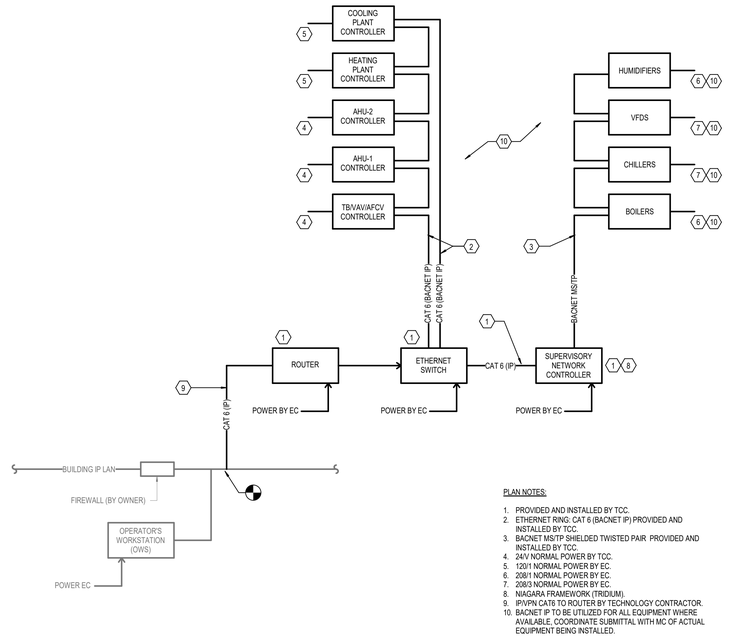
5 DOMESTIC WATER FLOW METER TEMPERATURE CONTROL SCHEMATIC
NO SCALE



PLAN NOTES:

1. TRANSFORMER POWER SUPPLY TO BE COMPLETE WITH ON/OFF SWITCH & BREAKER, 200 VA MIN., AND IN NEMA 1 ENCLOSURE. PRIMARY FEED TO BE 120/60 VAC; OUTPUT TO BE 24 VAC. TRANSFORMER TO BE RIB FUNCTIONAL DEVICES PSH200A OR EQUAL. SHALL CONTAIN A MINIMUM OF FOUR (4) 100 VA OUTPUT TERMINALS.
2. TRANSFORMER PANELS TO BE LOCATED WHERE SHOWN ON PLANS.
3. DISCONNECT FURNISHED AND INSTALLED BY EC.

4 TB POWER SUPPLY CONTROL SCHEMATIC
NO SCALE



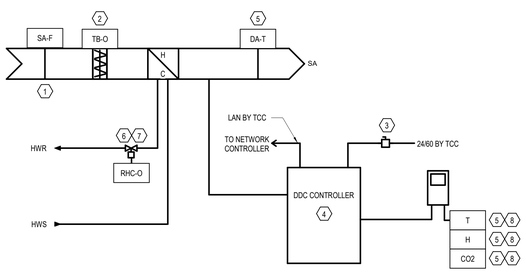
PLAN NOTES:

1. PROVIDED AND INSTALLED BY TCC.
2. ETHERNET RING: CAT 6 (BACNET IP) PROVIDED AND INSTALLED BY TCC.
3. BACNET MS/TP SHIELDED TWISTED PAIR PROVIDED AND INSTALLED BY TCC.
4. 24/V NORMAL POWER BY TCC.
5. 120/1 NORMAL POWER BY EC.
6. 208/1 NORMAL POWER BY EC.
7. 208/3 NORMAL POWER BY EC.
8. NIAGARA FRAMEWORK (TRIDIUM).
9. IP/VPN CAT6 TO ROUTER BY TECHNOLOGY CONTRACTOR.
10. BACNET IP TO BE UTILIZED FOR ALL EQUIPMENT WHERE AVAILABLE. COORDINATE SUBMITTAL WITH MC OF ACTUAL EQUIPMENT BEING INSTALLED.

2 BAS SYSTEM ARCHITECTURE
NO SCALE

DDC POINT SCHEDULE - HW VAV

CONTROLLER POINT & TYPE	OBJECT NAME	OBJECT DESCRIPTION	UNITS	TREND	ALARM	GRAPHIC	NOTES
AI	DA-T	DISCHARGE AIR TEMPERATURE	DEG F	Yes	No	Yes	
AI	TB-O	TB DAMPER OUTPUT	% OUTPUT	Yes	No	Yes	
AI	T	SPACE TEMP	DEG F	Yes	No	Yes	
AI	H	SPACE HUMIDITY	% RH	Yes	No	Yes	
AI	CO2	SPACE CARBON DIOXIDE	PPM	Yes	No	Yes	
AI	SA-F	SUPPLY AIRFLOW	CFM	Yes	No	Yes	
AO	RHC-O	RE-HEAT COIL VALVE OUTPUT	% OPEN	Yes	No	Yes	



PLAN NOTES:

1. FLOW SENSOR INTEGRAL WITH TERMINAL BOX.
2. TERMINAL BOX ACTUATOR FURNISHED BY TCC; INSTALLED BY TERMINAL BOX SUPPLIER. COMMISSIONED BY CXA.
3. TERMINAL BOX DISCONNECT PROVIDED BY TERMINAL BOX MANUFACTURER.
4. DDC CONTROLLER FURNISHED BY TCC; INSTALLED BY BOX SUPPLIER. COMMISSIONED BY CXA.
5. FURNISHED, INSTALLED, AND WIRED BY TCC. COMMISSIONED BY CXA.
6. FURNISHED BY TCC AND INSTALLED BY MC.
7. FAIL IN LAST POSITION.
8. REFER TO PLANS FOR LOCATIONS AND QUANTITIES.

SEQUENCE OF OPERATION - VAV BOXES:

1. THE VARIABLE AIR VOLUME (VAV) TERMINAL UNIT IS CONTROLLED INDEPENDENT OF SYSTEM PRESSURE FLUCTUATIONS AND CHANGES IN SPACE TEMPERATURE BY MODULATING SUPPLY AIR VOLUME FROM SCHEDULED MINIMUM TO SCHEDULE MAXIMUM AIRFLOW VALUES WHILE MODULATING RE-HEAT VALVE TO MAINTAIN SPACE TEMPERATURE.
2. WHEN THE ZONE STATE IS COOLING, THE COOLING LOOP OUTPUT SHALL MODULATE FROM SCHEDULED MINIMUM TO SCHEDULED MAXIMUM AIRFLOWS.
3. WHEN THE ZONE STATE IS DEADBAND, THE AIRFLOW SETPOINT SHALL BE AT MINIMUM SCHEDULED AIRFLOW WITH HEATING COIL DISABLED
4. WHEN THE ZONE STATE IS HEATING, THE HEATING LOOP SHALL MAINTAIN SPACE TEMPERATURE AS FOLLOWS:
   A. STAGE 1: FOR AN OUTPUT OF 0-50%, THE HEATING LOOP SHALL MODULATE THE TERMINAL UNIT REHEAT CONTROL VALVE TO MAINTAIN SPACE TEMPERATURE AT THE SCHEDULED MINIMUM AIRFLOW NOT EXCEEDING 90°F (ADJ) DISCHARGE AIR TEMPERATURE.
   B. STAGE 2: IF ADDITIONAL HEAT IS REQUIRED, FOR AN OUTPUT OF 51-100%, THE HEATING LOOP SHALL MODULATE THE AIRFLOW FROM SCHEDULED MINIMUM TO SCHEDULED HEATING MAX WHILE NOT EXCEEDING 90°F (ADJ) DISCHARGE AIR TEMPERATURE.
5. ANYTIME THE CO2 LEVEL EXCEEDS 800 PPM (ADJ) AS SENSED BY THE SPACE CO2 SENSOR, THE TERMINAL BOX DAMPER SHALL MODULATE TO INCREASE THE SUPPLY AIR VOLUME FROM ITS SCHEDULED MINIMUM FLOW TO THE SCHEDULED MAXIMUM COOLING FLOW TO LOWER PPM BACK TO 800 PPM (ADJ). REHEAT COIL VALVE MODULATES TO MAINTAIN SPACE TEMPERATURE. INITIATE AN ALARM TO THE BAS IN THE EVENT C02 EXCEEDS 900 PPM (ADJ) FOR LONGER THAN 15 MINUTES.
6. WHEN THE ASSOCIATED AHU SUPPLY FAN IS DE-ENERGIZED, EACH TERMINAL UNIT AND HEATING COIL CONTROL VALVE SHALL BE INDEXED TO THE FULLY CLOSED POSITION.
7. TEMPERATURE CONTROL BASED ON TIME SCHEDULE AND/OR OCCUPANCY SENSORS AS FOLLOWS:
   A. OCCUPIED MODE (ROOM OCCUPANCY SENSED OR OPERATOR SCHEDULE)
      HEATING SETPOINT = 70°F (ADJ)
      COOLING SETPOINT = 72°F (ADJ)
      TERMINAL BOX AIR DAMPER CONTROLS TO AIRFLOW SETPOINT
   B. STANDBY MODE (BUILDING OCCUPANCY SCHEDULE ON, ROOM OCCUPANCY NOT SENSED FOR 30 MINUTES)
      HEATING SETPOINT = 67 °F (ADJ)
      COOLING SETPOINT = 75 °F (ADJ)
      TERMINAL BOX AIR DAMPER REMAINS FULLY CLOSED UNTIL THE SPACE TEMPERATURE SURPASSES THE STANDBY HEATING OR COOLING SETPOINT. THE DAMPER IS THEN OPENED TO MINIMUM POSITION UNTIL THE ASSOCIATED STANDBY SETPOINT IS SATISFIED.
   C. UNOCCUPIED MODE (BUILDING OCCUPANCY SCHEDULE OFF)
      HEATING SETPOINT = 60°F (ADJ)
      COOLING SETPOINT = 78°F (ADJ)
      TERMINAL BOX AIRFLOW DAMPER FULLY CLOSED UNTIL UNOCCUPIED SETPOINTS ARE REACHED, THEN CONTROL TO STANDBY SETPOINTS

SEQUENCE OF OPERATION - CAV BOXES:

1. THE CONSTANT AIR VOLUME (CAV) TERMINAL UNIT IS CONTROLLED INDEPENDENT OF SYSTEM PRESSURE FLUCTUATIONS AND CHANGES IN SPACE TEMPERATURE BY MAINTAINING A CONSTANT AIRFLOW AND MODULATING RE-HEAT VALVE TO MAINTAIN SPACE TEMPERATURE.
2. REFER TO VAV SEQUENCE FOR RADIANT HEAT AND TEMPERATURE SETBACK SEQUENCES.

3 TERMINAL BOX CONTROL SCHEMATIC
NOT TO SCALE

PLAN NOTES

1. CONNECT ANALOG INPUT POINTS TO NEAREST DDC PANEL: TEMPERATURE, HUMIDITY. CALCULATE ENTHLAPY ON BAS. THESE POINTS WILL BE MAPPED TO VARIOUS TIER 2 DDC CONTROLLERS.
2. REFER TO DRAWINGS FOR LOCATION.
3. VAISALA HMS110 SERIES HUMIDITY AND TEMPERATURE TRANSMITTER, OR APPROVED EQUIVALENT.

1 OUTDOOR AIR TRANSMITTER
NOT TO SCALE

TEMPERATURE CONTROLS SYMBOLS

(REFER TO PIPING IDENTITY SYMBOLS FOR PIPING ACCESSORIES)

CT	CURRENT TRANSDUCER	CS	CURRENT SENSOR	LS	HIGH LEVEL SWITCH (WATER)
M	MOTOR OR MOTORIZED DAMPER	S	SWITCH	TR	TRANSFORMER
DP	DIFFERENTIAL PRESSURE				
	FAN		PUMP		FILTER
STR/HOA	STARTER (HAND-ON-AUTO)	VFD	VARIABLE FREQUENCY DRIVE		MOTORIZED DAMPER
	DISCONNECT	DDC CONTROLLER	DIRECT DIGITAL CONTROLS CONTROLLER(S)		
C C	COOLING COIL (WATER)	D X	DX COIL	H C	HEATING COIL
	THERMOWELL		AIR BLENDER		HUMIDIFIER
T	TEMPERATURE SENSOR OR THERMOSTAT	H	HUMIDITY SENSOR OR HUMIDISTAT	CO2	CARBON DIOXIDE SENSOR
CO-S	CARBON MONOXIDE SENSOR	NO2-S	NITROGEN DIOXIDE SENSOR	CO	CARBON MONOXIDE SENSOR

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SHEET ISSUE

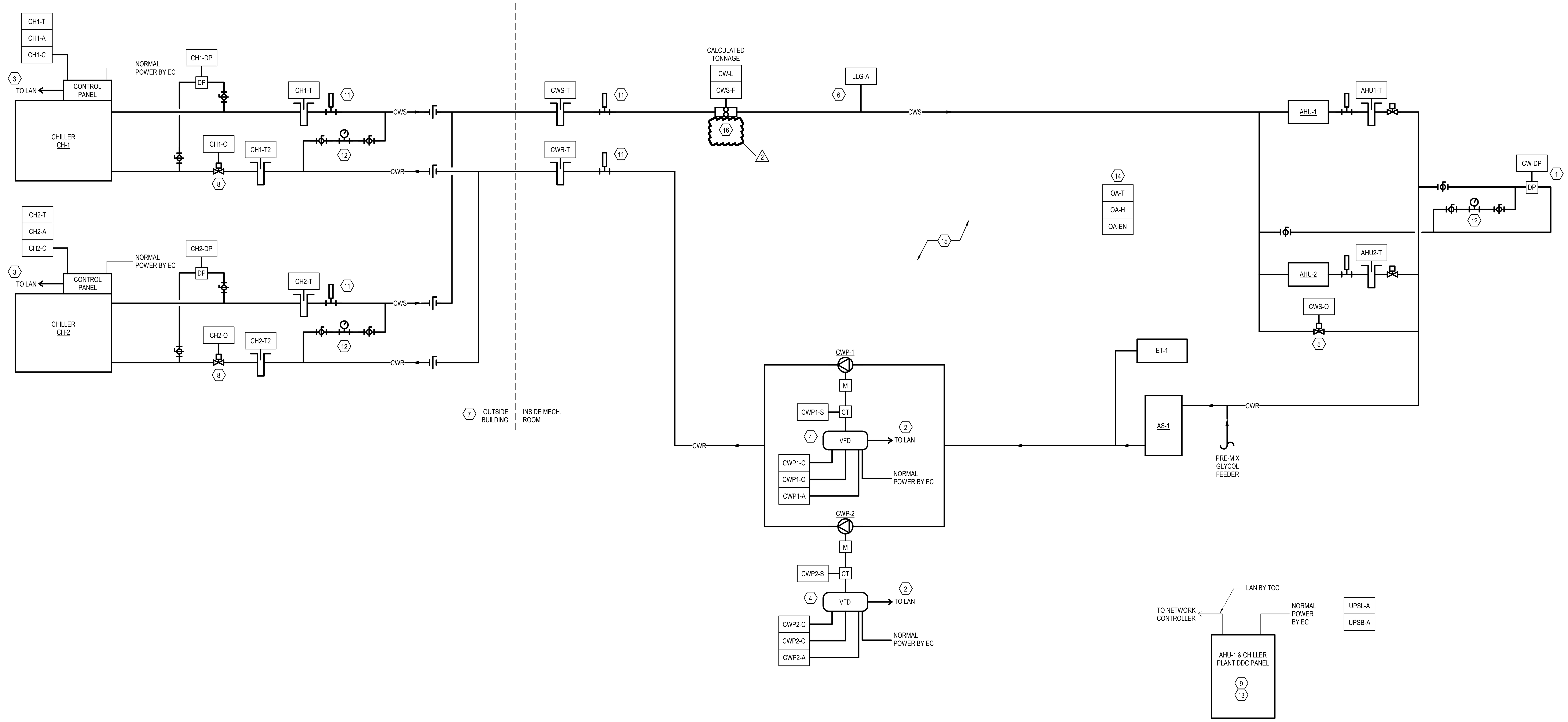
1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
TEMPERATURE CONTROL SCHEMATICS

SHEET NUMBER
M-901

7/23/2024 2:52:27 PM



DDC POINT SCHEDULE - COOLING PLANT

CONTROLLER POINT & TYPE	OBJECT NAME	OBJECT DESCRIPTION	UNITS	TREND	ALARM	GRAPHIC	NOTES
AI-1	OA-T	OUTDOOR AIR TEMPERATURE (GLOBAL)	DEG F	Yes	No	Yes	
AI-2	CWS-T	SYSTEM CHILLED WATER SUPPLY TEMPERATURE	DEG F	Yes	Yes	Yes	
AI-3	CWR-T	SYSTEM CHILLED WATER RETURN TEMPERATURE	DEG F	Yes	No	Yes	
AI-4	CH1-DP	CH-1 DIFFERENTIAL PRESSURE	PSIG	Yes	Yes	Yes	
AI-5	CH2-DP	CH-2 DIFFERENTIAL PRESSURE	PSIG	Yes	Yes	Yes	
AI-6	CW-DP	SYSTEM DIFFERENTIAL PRESSURE	PSIG	Yes	No	Yes	
AI-7	CWS-F	SYSTEM CHILLED WATER FLOW	GPM	Yes	No	Yes	
AI-8	CW-L	SYSTEM CHILLED WATER CALCULATED LOAD (VIRTUAL)	TONS	Yes	No	Yes	
AI-9	OA-H	OUTDOOR AIR HUMIDITY (GLOBAL)	% RH	Yes	No	Yes	
AI-10	OA-EN	OUTDOOR AIR ENTHALPY (GLOBAL)	BTU/LBda	Yes	No	Yes	CALCULATED
AI-11	CH1-T	CH-1 SUPPLY TEMPERATURE	DEG F	Yes	No	Yes	
AI-12	CH1-T2	CH-1 RETURN TEMPERATURE	DEG F	Yes	No	Yes	
AI-13	CH2-T	CH-2 SUPPLY TEMPERATURE	DEG F	Yes	No	Yes	
AI-14	CH2-T2	CH-2 RETURN TEMPERATURE	DEG F	Yes	No	Yes	
AI-15	AHU1-T	AHU-1 GR TEMPERATURE	DEG F	Yes	No	Yes	
AI-16	AHU2-T	AHU-2 GR TEMPERATURE	DEG F	Yes	No	Yes	
AO-1	CWP1-O	CWP-1 VFD SPEED	%	Yes	No	Yes	
AO-2	CWP2-O	CWP-2 VFD SPEED	%	Yes	No	Yes	
AO-3	CH1-T	CHILLER CH-1 TEMPERATURE SETPOINT	DEG F	Yes	No	Yes	
AO-4	CH2-T	CHILLER CH-2 TEMPERATURE SETPOINT	DEG F	Yes	No	Yes	
AO-5	CWS-O	CHILLED WATER SYSTEM BYPASS VALVE OUTPUT	% OPEN	Yes	No	Yes	
BI-1	LLG-A	LOW LEVEL GLYCOL ALARM - CHILLED WATER	-	Yes	Yes	Yes	
BI-2	UPSL-A	UPS LOW BATTERY ALARM	-	No	Yes	Yes	
BI-3	CWP1-S	CHILLED WATER PUMP CWP-1 STATUS	OFF/ON	Yes	No	Yes	
BI-4	CWP2-S	CHILLED WATER PUMP CWP-2 STATUS	OFF/ON	Yes	No	Yes	
BI-5	CH1-A	CHILLER CH-1 GENERAL ALARM	-	No	Yes	Yes	
BI-6	CH2-A	CHILLER CH-2 GENERAL ALARM	-	No	Yes	Yes	
BI-7	CWP1-A	CWP-1 VFD FAULT - ALARM	-	No	Yes	Yes	
BI-8	CWP2-A	CWP-2 VFD FAULT - ALARM	-	No	Yes	Yes	
BI-9	UPSB-A	UPS ON BATTERY ALARM	-	No	Yes	Yes	
BO-1	CWP1-C	CHILLED WATER PUMP CWP-1 COMMAND	START/STOP	Yes	Yes	Yes	
BO-2	CWP2-C	CHILLED WATER PUMP CWP-2 COMMAND	START/STOP	Yes	Yes	Yes	
BO-3	CH1-C	CHILLER CH-1 COMMAND	START/STOP	Yes	Yes	Yes	
BO-4	CH2-C	CHILLER CH-2 COMMAND	START/STOP	Yes	Yes	Yes	
BO-5	CH1-O	CHILLER CH-1 ISOLATION VALVE	% OPEN	Yes	No	Yes	
BO-6	CH2-O	CHILLER CH-2 ISOLATION VALVE	% OPEN	Yes	No	Yes	

SEQUENCE OF OPERATION:

1. ALL SETPOINTS TO BE ADJUSTABLE AND EXPOSED ON BAS.
2. ENABLE THE CHILLED WATER SYSTEM ANYTIME THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 48°F (ADJ).
3. DISABLE AND SHUT DOWN THE CHILLED WATER SYSTEM ANYTIME THE OUTDOOR AIR TEMPERATURE FALLS BELOW 45°F (ADJ).
4. SAFETIES AND ALARMS *(NOTE ALARMS SHALL BE GENERATED AT THE BAS AND SEND NOTIFICATIONS TO STAFF AS SPECIFIED BY CLIENT)*:
   A. LOW LEVEL GLYCOL ALARM.
   B. CHILLER COMMAND ALARM.
   C. CHILLER FLOW ALARM.
   D. PUMP COMMAND ALARM.
   E. VFD FAULT ALARM.
   F. GENERATE ALARM ANYTIME SUPPLY TEMPERATURE DIFFERS FROM SET POINT BY GREATER THAN 5°F (ADJ) WHEN SYSTEM IS ENABLED FOR 30 MINUTES OR GREATER.
5. CHILLERS:
   A. NOTE THAT TWO (2) CHILLERS ARE REQUIRED TO RUN TO MEET MAXIMUM COOLING LOAD OF FACILITY.
   B. CHILLERS ARE MANUALLY INDEXED FOR AUTOMATIC OPERATION THROUGH INTEGRAL ON-OFF SWITCHES.
   C. CHILLERS OPERATE IN LEAD/LAG CONFIGURATION. CHILLERS SHALL ALTERNATE IN THE LEAD POSITION EVERY 750 HOURS (ADJ). FAILURE OF A CHILLER TO START WHEN COMMANDED BY THE BAS SHALL START THE LAG CHILLER AND ALARM BAS. IF CHILLER IS IN ALARM ITS ISOLATION VALVE SHALL BE CLOSED.
   D. THE SYSTEM CHILLED WATER SET POINT SHALL BE DETERMINED BY THE FOLLOWING:
      a. 42°F (ADJ) ≥ 80°F OAT (ADJ)
      b. 52°F (ADJ) ≤ 60°F OAT (ADJ)
      c. LINEARLY BETWEEN 42-52°F (ADJ) AND 80-60°F OAT (ADJ)
   E. THE SYSTEM SHALL BE INITIATED BY OPENING ISOLATION VALVE FOR LEAD CHILLER (ISOLATION VALVE TO FULLY OPEN OVER 90 SECOND TIME DELAY OR AT A RATE SLOW ENOUGH SUCH THAT CHILLER DOES NOT SHUT DOWN DUE TO LOW FLOW), ENABLE LEAD PUMP AND RUN FOR 4 MIN (ADJ) TIME DELAY, AND ENERGIZE LEAD CHILLER ONCE THERE IS PROOF OF FLOW. CHILLERS TO BE SUPPLIED WITH INTEGRAL SAFETY DIFFERENTIAL PRESSURE FLOW SWITCH WHICH SHALL ACTIVE AN ALARM AND SHUTN DOWN CHILLER ON LOSS OF FLOW.
   F. STAGING SHALL BE AS FOLLOWS:
      a. CHILLERS TO UTILIZE INTERNAL CONTROLS FOR STAGING FOR PEAK EFFICIENCY.
      b. LOAD (TONS) = ((GR (°F) - GS (°F)) X FLOW (GPM)) / 26.2. FLOW METER ON RETURN SYSTEM LOCATED IN MECHANICAL ROOM ALONG WITH GS&R SYSTEM TEMPERATURES WILL BE USED IN ABOVE LOAD EQUATION.
6. CHILLED WATER PUMPS:
   A. PUMPS ALTERNATE AS LEAD/STANDBY EVERY 750 HOURS (ADJ.) OF OPERATION. FAILURE OF ANY PUMP SHALL AUTOMATICALLY START THE NEXT PUMP IN THE OPERATING SEQUENCE AND ALARM BAS.
   B. PUMPS MODULATE FROM 20 TO 60 HZ (ADJ) TO MAINTAIN THE REQUIRED DIFFERENTIAL PRESSURE OF 20 PSID (ADJ), FINAL SET POINT DETERMINED BY TAB.
   C. WHEN A CHILLER IS ENABLED, THE NEXT PUMP IN SERVICE SHALL BE INDEXED TO START.
   D. WHEN A CHILLER IS DISABLED, THE LAST PUMP IN SERVICE SHALL BE INDEXED TO STOP.
7. CHILLED WATER BYPASS VALVE:
   A. THE CHILLED WATER BYPASS VALVE SHALL MODULATE OPEN TO MAINTAIN THE SYSTEM FLOW RATE ABOVE THE REQUIRED MINIMUM FLOW RATE BASED ON THE OPERATING CHILLER(S) AS MEASURED BY CHILLER DIFFERENTIAL PRESSURE SENSOR.

PLAN NOTES

1. LOCATED AT 90% THROUGH HEATING HOT WATER SYSTEM WHERE SHOWN ON PLAN. HARD WIRED TO HEATING HOT WATER DDC PANEL. REFER TO DRAWING M-402 FOR LOCATION. MC TO ADD BALL VALVES AND PRESSURE GAGE AS INDICATED ON THIS SHEET.
2. VFD TO TRANSMIT TO BAS STATUS AND ALARMS OF ALL DATA AVAILABLE. VFD SUPPLIER TO FURNISH INTEGRAL COMMUNICATION CARD. TCC TO MAP ALL OWNER REQUESTED INFORMATION POINTS. NOTE THAT START/STOP SIGNAL, STATUS AND SPEED CONTROL ARE HARD WIRED TO DDC TO ENSURE OPERATION ON LOSS OF LAN.
3. CHILLER TO TRANSMIT TO BAS STATUS AND ALARMS OF ALL DATA AVAILABLE. CHILLER SUPPLIER TO FURNISH INTEGRAL COMMUNICATION CARD. TCC TO MAP ALL OWNER REQUESTED INFORMATION POINTS. NOTE THAT ENABLE/DISABLE SIGNAL AND TEMPERATURE SET POINT ARE HARD WIRED TO DDC TO ENSURE OPERATION ON LOSS OF LAN.
4. VFD DRIVES FURNISHED, INSTALLED, WIRED AND COMMISSIONED BY EC. VFD SHALL MODULATE FROM THE CONTROLLED EQUIPMENT MANUFACTURER'S REQUIRED SAFE OPERATING MAXIMUM AND MINIMUM SPEED.
5. SYSTEM MODULATING BYPASS VALVE SIZED FOR 120 GPM AT 5 PSID. VALVE TO FAIL IN LAST POSITION. COORDINATE MINIMUM GPM WITH ACTUAL SELECTED CHILLER AS MANUFACTURERS MAY VARY.
6. LOW GLYCOL ALARM SENSING POINT TO BE AT HIGHEST ELEVATION IN SYSTEM.
7. TCC & MC TO NOTE THAT CHILLERS ARE AIR COOLED AND INSTALLED OUTDOORS. ANY TEMPERATURE CONTROLS INSTALLED OUTDOORS SHALL BE PROTECTED IN WEATHERPROOF ENCLOSURE.
8. ISOLATION VALVES: SPRING RETURN OPEN UPON LOSS OF POWER, 24 VDC LOW VOLTAGE VALVE. ISOLATION VALVES FURNISHED BY TCC AND INSTALLED BY MC.
9. UPS BY TCC TO ALLOW ALL CONTROL AND ALARM LOOPS TO REMAIN IN OPERATION FOR 5 MINUTES FOLLOWING ELECTRICAL "BLIP" OR FULL SHUTDOWN. UPS TO BE COMPLETE WITH MAINTENANCE BYPASS SWITCH TO ACCOMMODATE BATTERY MAINTENANCE. TO BE MOUNTED ADJACENT TO DDC CONTROLLER. PROVIDE ALARMS NOTED BY POINTS.
10. TREND DATA AT A MINIMUM 15 MINUTE INTERVAL AND STORE DATA FOR A MINIMUM OF 30 DAYS. INCLUDE TRENDS FOR COMMANDS AND/OR SETPOINT. PROVIDE CHANGE OF VALUE AND INTERVAL TRENDS FOR BINARY POINTS.
11. LOCAL THERMOMETER MANUAL READOUT ONLY.
12. LOCAL PRESSURE GAGE MANUAL READOUT ONLY.
13. PROVIDE 20% SPARE CAPACITY WORTH OF INPUTS AND OUTPUTS FOR FUTURE USE. (2)
14. REFER TO OUTDOOR SENSOR SCHEMATIC FOR DETAILS. ENTHALPY VALUE IS CALCULATED.
15. SYSTEM CONTAINS 30% PROPYLENE GLYCOL MEDIA BUT IS TAGGED AS CWS&R TO MATCH EXISTING CONDITIONS.
16. FLOW METER PROVIDED BY TCC AND INSTALLED BY MC. REFER TO SPECIFICATION SECTION 230923 FOR FURTHER INFORMATION. (2)

1 AIR COOLED CHILLED WATER (GLYCOL) CONTROL SCHEMATIC

NO SCALE

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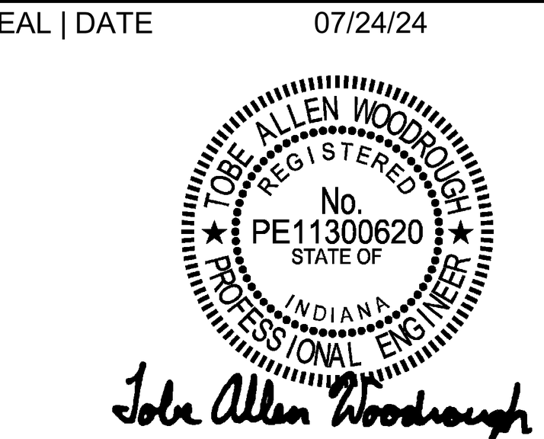
SEAL | DATE 07/24/24



SHEET ISSUE

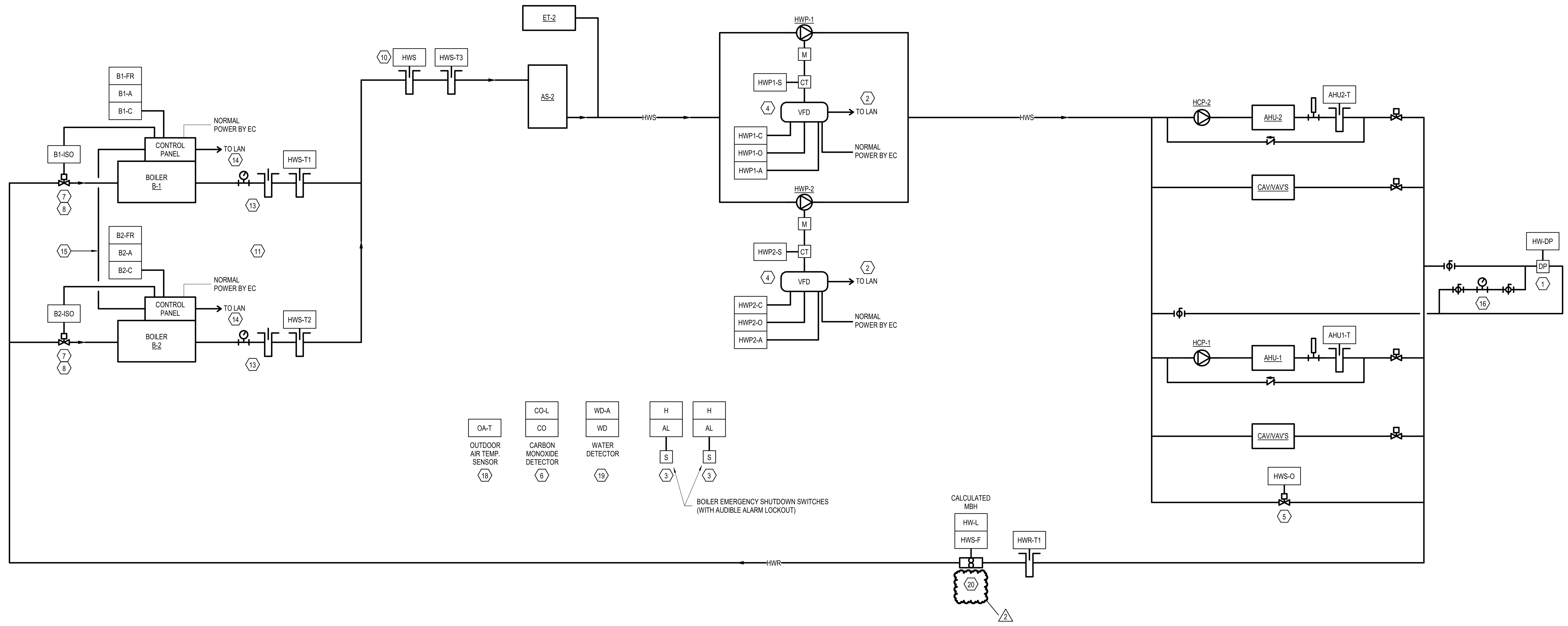
1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

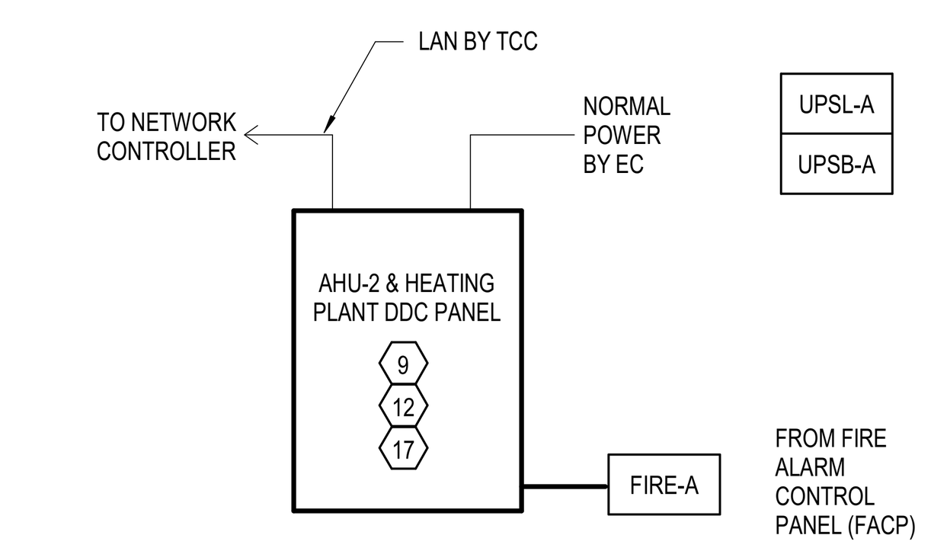
RATIO

PROJECT NO. 21730.001

SHEET TITLE
TEMPERATURE CONTROL SCHEMATICS

SHEET NUMBER
M-902





DDC POINT SCHEDULE - HEATING PLANT

CONTROLLER POINT & TYPE	OBJECT NAME	OBJECT DESCRIPTION	UNITS	TREND	ALARM	GRAPHIC	NOTES
--	WD	WATER DETECTOR		No	Yes	Yes	
--	H	AUDIBLE ALARM HORN		No	Yes	Yes	VISUAL AND AUDIBLE ALARM IN BOILER ROOM
--	CO	CARBON MONOXIDE SENSOR		No	Yes	Yes	
--	HWS	SYSTEM HOT WATER SUPPLY TEMPERATURE		Yes	Yes	Yes	SENSOR TO CONTROL BOILER TEMPERATURE
--	B2-ISO	BOILER B-2 HEATING WATER ISOLATION VALVE		Yes	Yes	Yes	
--	B1-ISO	BOILER B-1 HEATING WATER ISOLATION VALVE		Yes	Yes	Yes	
--	H	AUDIBLE ALARM HORN		No	Yes	Yes	VISUAL AND AUDIBLE ALARM IN BOILER ROOM
AI-1	OA-T	OUTDOOR AIR TEMPERATURE (GLOBAL)	DEG F	Yes	No	Yes	
AI-2	HWS-T3	SYSTEM HOT WATER SUPPLY TEMPERATURE	DEG F	Yes	Yes	Yes	
AI-3	HWS-T1	BOILER B-1 SUPPLY TEMPERATURE	DEG F	Yes	No	Yes	
AI-4	HWS-T2	BOILER B-2 SUPPLY TEMPERATURE	DEG F	Yes	No	Yes	
AI-5	HWR-T1	SYSTEM HOT WATER RETURN TEMPERATURE	DEG F	Yes	No	Yes	
AI-6	HW-DP	SYSTEM DIFFERENTIAL PRESSURE	PSIG	Yes	No	Yes	
AI-7	HWS-F	SYSTEM HEATING HOT WATER FLOW	GPM	Yes	No	Yes	
AI-8	HW-L	SYSTEM HOT WATER CALCULATED LOAD (VIRTUAL)	MBH	Yes	No	Yes	
AI-9	CO-L	CARBON MONOXIDE LEVEL	PPM	Yes	Yes	Yes	
AI-10	AHU2-T	AHU-2 HWR TEMPERATURE	DEG F	Yes	No	Yes	NOTE POINT TO BE CONNECT TO AHU DDC PANEL
AI-12	AHU1-T	AHU-1 HWR TEMPERATURE	DEG F	Yes	No	Yes	NOTE POINT TO BE CONNECT TO AHU DDC PANEL
AO-1	HWP1-O	HWP-1 VFD SPEED	%	Yes	No	Yes	
AO-2	HWP2-O	HWP-2 VFD SPEED	%	Yes	No	Yes	
AO-3	B1-FR	BOILER B-1 FIRING RATE	%	Yes	No	Yes	
AO-4	B2-FR	BOILER B-2 FIRING RATE	%	Yes	No	Yes	
AO-5	HWS-O	HEATING WATER SYSTEM BYPASS VALVE OUTPUT	% OPEN	Yes	No	Yes	
BI-1	FIRE-A	FIRE ALARM CONTROL PANEL RELAY		No	Yes	Yes	
BI-2	UPSL-A	UPS LOW BATTERY ALARM		No	Yes	Yes	
BI-3	HWP1-S	HEATING HOT WATER PUMP HWP-1 STATUS	OFF/ON	Yes	No	Yes	
BI-4	HWP2-S	HEATING HOT WATER PUMP HWP-2 STATUS	OFF/ON	Yes	No	Yes	
BI-5	B1-A	BOILER B-1 GENERAL ALARM		No	Yes	Yes	
BI-6	B2-A	BOILER B-2 GENERAL ALARM		No	Yes	Yes	
BI-7	HWP1-A	HWP-1 VFD FAULT - ALARM		No	Yes	Yes	
BI-8	HWP2-A	HWP-2 VFD FAULT - ALARM		No	Yes	Yes	
BI-9	UPSB-A	UPS ON BATTERY ALARM		No	Yes	Yes	
BI-10	WD-A	BOILER ROOM WATER DETECTOR ALARM		No	Yes	Yes	
BI-11	AL	BAS ALARM - EMERGENCY BOILER SHUTDOWN SWITCH		No	Yes	Yes	ALARM BMS
BI-11	AL	BAS ALARM - EMERGENCY BOILER SHUTDOWN SWITCH		No	Yes	Yes	ALARM BMS
BO-1	HWP1-C	HEATING HOT WATER PUMP HWP-1 COMMAND	START/STOP	Yes	Yes	Yes	
BO-2	HWP2-C	HEATING HOT WATER PUMP HWP-2 COMMAND	START/STOP	Yes	Yes	Yes	
BO-3	B1-C	BOILER B-1 START/STOP	START/STOP	Yes	Yes	Yes	
BO-4	B2-C	BOILER B-2 START/STOP	START/STOP	Yes	Yes	Yes	

SEQUENCE OF OPERATION:

1. ALL SETPOINTS TO BE ADJUSTABLE. SETPOINTS TO BE EXPOSED ON GRAPHIC DISPLAY OR HIDDEN BASED ON OWNER REQUEST.
2. ENABLE: THE HEATING HOT WATER SYSTEM IS STARTED FROM DDC PANEL OR FROM COMMAND OF BUILDING MANAGEMENT SYSTEM. SYSTEM TO RUN CONTINOUSLY.
3. DISABLE: WHEN SYSTEM IS DISABLED MANUALLY THROUGH THE BUILDING MANAGEMENT SYSTEM, BOILERS ARE DISABLED AND PUMPS STOP.
4. BOILERS:
   A. BOILERS ARE MANUALLY INDEXED FOR AUTOMATIC OPERATION THROUGH INTEGRAL ON-OFF SWITCHES. ALL BOILERS ARE AVAILABLE FOR SERVICE AT ALL TIMES FOR NORMAL OPERATION.
   B. A MINIMUM OF ONE BOILER SHALL ALWAYS BE ENABLED.
   C. ANY BOILER TAKEN OUT OF SERVICE (MANUALLY DEENERGIZED) SHALL BE NOTED ON THE GRAPHICS AND IT SHALL BE REMOVED FROM THE CONTROL SEQUENCE.
   D. THE FIRING RATE OF EACH BOILER SHALL BE ACCOMPLISHED THROUGH THE BOILER CONTROL PANEL AT EACH BOILER. BOILERS SHALL FIRE TO ACHIEVE A SUPPLY WATER TEMPERATURE DICTATED BY OUTDOOR INVERSE RESET. (OUTDOOR TEMPERATURE TO BE SUPPLIED BY TCC FROM OUTDOOR MASTER SENSOR TO LAN). ROTATE BOILER OPERATION WHEN DETERMINING WHICH BOILER TO ENABLE BY ENABLING THE UNIT WITH THE LEAST AMOUNT OF RUNTIME. WHEN ROTATING BOILERS OUT OF SEQUENCE DISABLE THE BOILER WITH THE MOST RUN-HOURS. DISPLAY BOILER RUN-HOURS AND RUN-CYCLES ON THE OWS GRAPHICS.
   E. MULTIPLE BOILERS SHALL RUN IN LOW FIRE MODE BEFORE MODULATING FIRING RATE TOWARD HIGHER FIRE TO MAINTAIN HIGHEST EFFICIENCY POSSIBLE.
   F. ROTATE BOILER OPERATION WHEN DETERMINING WHICH BOILER TO ENABLE BY ENABLING THE UNIT WITH LEAST AMOUNT OF RUNTIME. WHEN ROTATING BOILERS OUT OF SEQUENCE DISABLE THE BOILER WITH THE MOST RUN-HOURS. DISPLAY BOILER RUN-HOURS AND ON/OFF RUN CYCLES ON THE OWS GRAPHICS.
   G. THE SYSTEM SUPPLY HEATING HOT WATER SET POINT SHALL BE 130°F (ADJ). RESET HEATING HOT WATER FROM 130°F TO 110°F AS THE OUTDOOR AIR VARIES FROM 30°F TO 70°F.
   H. EACH BOILER CONTROLS ITS ISOLATION VALVE. LEAD BOILER ISOLATION VALVE SHALL BE OPEN AT ALL TIMES. LAG BOILER ISOLATION VALVE SHALL OPEN WHENEVER BOILER IS CALLED TO OPERATE. CLOSE THE ISOLATION VALVE WHEN THE BOILER IS TAKEN OUT OF SEQUENCE AFTER A 5 MIN. (ADJ) TIME DELAY.
5. HEATING HOT WATER PUMPS:
   A. HEATING HOT WATER PUMPS SHALL OPERATE IN LEAD/STANDBY ARRANGEMENT. ONE (1) PUMP WILL HANDLE SYSTEM FLOW REQUIREMENTS.
   B. HEATING HOT WATER PUMPS SHALL ROTATE AS THE LEAD PUMP EVERY 750 HOURS (ADJ). FAILURE OF ANY PUMP SHALL AUTOMATICALLY START THE NEXT PUMP IN THE OPERATING SEQUENCE.
   C. A PUMP SHALL MODULATE FROM 20 TO 60 HZ (ADJ) TO MAINTAIN THE REQUIRED DIFFERENTIAL PRESSURE OF 15 PSID (ADJ), FINAL SET POINT DETERMINED BY TAB) 90% THROUGH THE HEATING HOT WATER PIPING SYSTEM. DIFFERENTIAL PRESSURE SET POINT SHALL BE RESET DOWNWARD BASED ON VALVE POSITION SUCH THAT THE WORST CASE CONTROL VALVE IS FULLY OPEN BASED ON A TRIM AND RESPOND LOOP OR SIMILAR LOGIC. THE MINIMUM DIFFERENTIAL PRESSURE SET POINT SHALL BE 10 PSID (ADJ).
6. HEATING HOT WATER BYPASS VALVE:
   A. THE HEATING HOT WATER BYPASS VALVE SHALL MODULATE OPEN TO MAINTAIN THE SYSTEM FLOW RATE ABOVE THE REQUIRED MINIMUM FLOW RATE BASED ON THE OPERATING BOILER(S) AS MEASURED BY SYSTEM FLOW METER, 30 GPM SET POINT CONFIRMED BY BOILER MANUFACTURER.
   B. SYSTEM BYPASS VALVE SHALL ALSO MODULATE OPEN TO MAINTAIN SYSTEM DIFFERENTIAL PRESSURE OF 2 PSID (ADJ) ABOVE EFFECTIVE SYSTEM DIFFERENTIAL SET POINT WHEN A SINGLE OPERABLE PUMP IS AT MINIMUM SPEED.
7. ALARMS:
   A. GENERATE ALARM ANYTIME SUPPLY TEMPERATURE DIFFERS FROM SET POINT BY GREATER THAN 5°F (ADJ).
   B. GENERATE ALARM ANYTIME CARBON MONOXIDE LEVEL IS ABOVE 25 PPM (ADJ) AND SHUT DOWN BOILERS LEVEL IS ABOVE 50 PPM (ADJ).
   C. MANUAL DEPRESSION OF EITHER EMERGENCY BOILER SHUTDOWN SWITCH SHALL SOUND HORN AND DISABLE ALL BOILERS.
   D. GENERATE ALARM ANYTIME WATER IS DETECTED BY WATER DETECTOR.

PLAN NOTES

1. LOCATED AT 90% THROUGH HEATING HOT WATER SYSTEM WHERE SHOWN ON PLAN. HARD WIRED TO HEATING HOT WATER DDC PANEL. REFER TO DRAWING M-401 FOR LOCATION. MC TO ADD BALL VALVES AND PRESSURE GAGE AS INDICATED ON THIS SHEET.
2. THRU THE LAN, VFD TO TRANSMIT TO BAS STATUS AND ALARMS OF ALL DATA AVAILABLE. VFD SUPPLIER TO FURNISH INTEGRAL COMMUNICATION CARD. TCC TO MAP ALL OWNER REQUESTED INFORMATION POINTS. NOTE THAT START/STOP SIGNAL, STATUS AND SPEED CONTROL ARE HARD WIRED TO DDC PANEL TO ENSURE OPERATION ON LOSS OF LAN.
3. TCC TO FURNISH, INSTALL, AND RECESS (EXCEPT BLOCK WALL; SURFACE MOUNT) ON/IN WALL INSIDE BOILER ROOM AN EMERGENCY LOCKOUT SWITCH (RED MUSHROOM 2" DIA. WITH PROTECTIVE COVER) HARD WIRED TO ALL OF THE HOT WATER BOILERS (PROVIDE MANUAL SILENCE SWITCH). NOTE THERE ARE TWO OF THESE, ONE PER EACH ENTRANCE INTO MECHANICAL ROOM.
4. VFD DRIVES FURNISHED, INSTALLED, WIRED AND COMMISSIONED BY EC. VFD SHALL MODULATE BETWEEN THE CONTROLLED EQUIPMENT MANUFACTURER'S REQUIRED SAFE OPERATING MAXIMUM AND MINIMUM SPEED.
5. SYSTEM MODULATING BYPASS VALVE SIZED FOR 80 GPM AT 5 PSID. VALVE TO FAIL IN LAST POSITION.
6. CARBON MONOXIDE DETECTOR LOCATED IN BOILER ROOM AT 48" AFF.
7. VALVE ACTUATION TO FAIL OPEN.
8. BOILER ISOLATION VALVE AND ACTUATOR SHALL BE PROVIDED BY BOILER MANUFACTURER AND INSTALLED BY MC. ACTUATOR SHALL BE FAST ACTUATING AND 24 VDC.
9. UPS BY TCC TO ALLOW ALL CONTROL AND ALARM LOOPS TO REMAIN IN OPERATION FOR 5 MINUTES FOLLOWING ELECTRICAL "BLIP" OR FULL SHUTDOWN. UPS TO BE COMPLETE WITH MAINTENANCE BYPASS SWITCH TO ACCOMMODATE BATTERY MAINTENANCE. TO BE MOUNTED ADJACENT TO DDC CONTROLLER. PROVIDE ALARMS NOTED BY POINTS.
10. BOILER MANUFACTURER PROVIDED TEMPERATURE SENSOR. LOCATE THIS SENSOR WITH IN 6" OF BAS TEMP SENSOR (HWS-T3; AI-2).
11. BOILERS PIPED IN REVERSE RETURN CONFIGURATION, EACH BOILER WILL HAVE BALANCE VALVES, REFER TO DETAIL.
12. PROVIDE 20% SPARE CAPACITY WORTH OF INPUTS AND OUTPUTS FOR FUTURE USE. (2)
13. LOCAL THERMOMETER AND PRESSURE GAGE MANUAL READOUT ONLY. GAGES TO BE TWO SEPARATE GAGES.
14. CONNECT BOILERS TO BAS NETWORK TO COMMUNICATE DESIRED INFORMATION TO BMS.
15. TCC TO CONNECT BOILERS TOGETHER WITH COMMUNCATION CABLE.
16. LOCAL PRESSURE GAGE MANUAL READOUT ONLY.
17. TREND DATA AT A MINIMUM 15 MINUTE INTERVAL AND STORE DATA FOR A MINIMUM OF 30 DAYS. INCLUDE TRENDS FOR COMMANDS AND/OR SETPOINT. PROVIDE CHANGE OF VALUE AND INTERVAL TRENDS FOR BINARY POINTS.
18. REFER TO OUTDOOR SENSOR SCHEMATIC FOR DETAILS. ENTHALPY VALUE IS CALCULATED.
19. LOCATE WATER SENSOR NEAR BOILER SAFETY RELIEF VALVES DISCHARGE AT FLOOR DRAIN.
20. FLOW METER PROVIDED BY TCC AND INSTALLED BY MC. REFER TO SPECIFICATION SECTION 230923 FOR FURTHER INFORMATION. (2)

1 HEATING HOT WATER CONTROL SCHEMATIC
NO SCALE

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SEAL | DATE 07/24/24

TOBE ALLEN WOODRUGH REGISTERED No. PE11300620 STATE OF INDIANA PROFESSIONAL ENGINEER

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

RATIO

PROJECT NO. 21730.001

SHEET TITLE
TEMPERATURE CONTROL SCHEMATICS

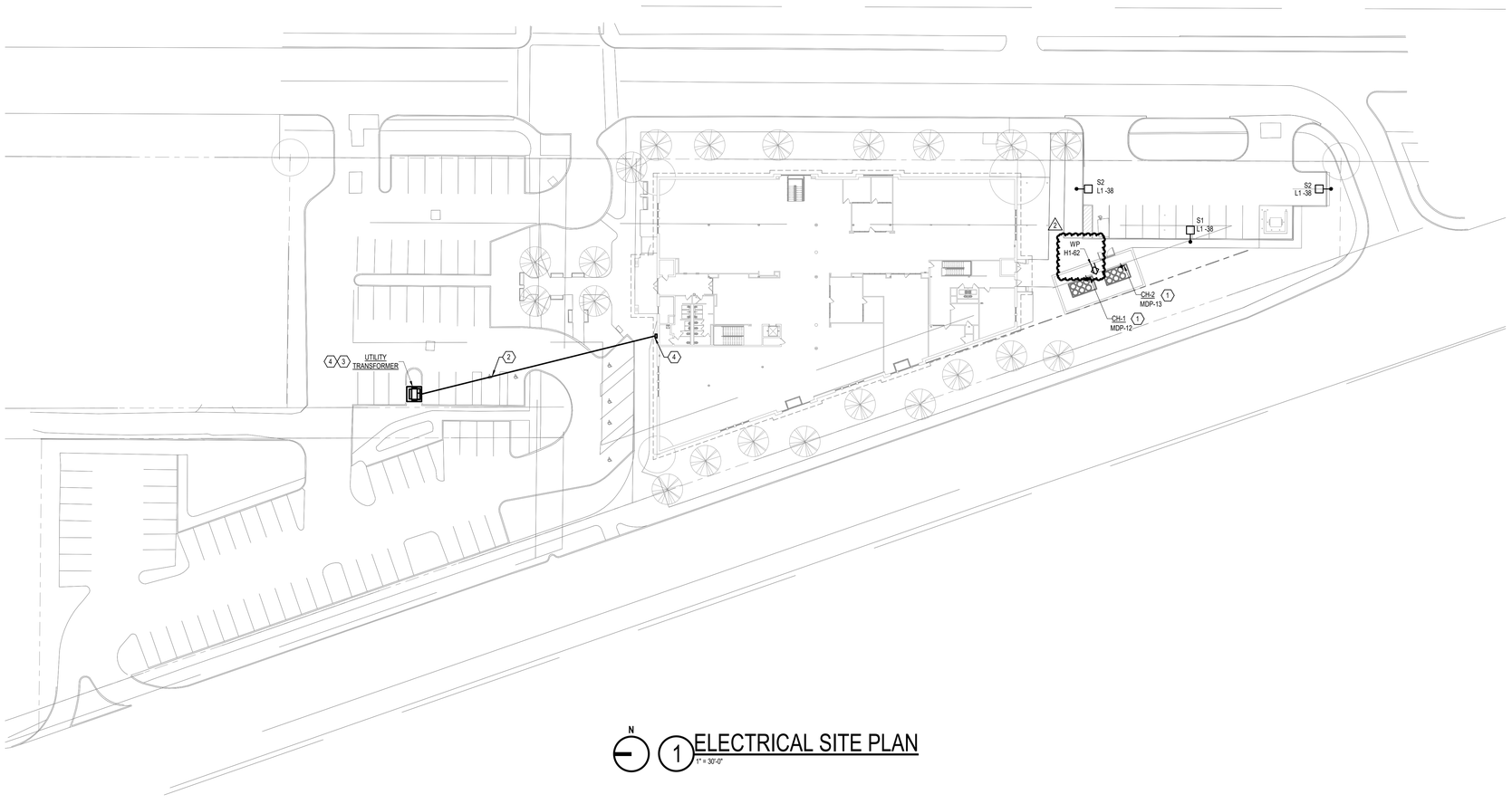
SHEET NUMBER
M-903

GENERAL NOTES

A REFER TO SHEET E-000 FOR GENERAL ELECTRICAL NOTES, SYMBOLS AND ABBREVIATIONS.
B REFER TO E-600 SERIES SHEETS FOR PANEL SCHEDULES.
C REFER TO E-500 SERIES SHEETS FOR LIGHTING DETAILS.
D COORDINATE EXACT PLACEMENT OF POLE BASES FOR LIGHTING AND CONDUITS WITH OTHER TRADES AND EXISTING UTILITIES PRIOR TO INSTALLATION. CONTRACTOR WILL MAKE ANY AND ALL ADJUSTMENTS NECESSARY TO AVOID CONFLICTS.
E LIGHTING SYSTEM SHALL INCLUDE THE DUSK TO DAWN CONTROL OF EXTERIOR LIGHT FIXTURES.
F ALL EXTERIOR EQUIPMENT AND DEVICES SHALL BE WEATHERPROOF AND RAIN TIGHT.
G ALL WORK SHALL COMPLY WITH NATIONAL, STATE AND LOCAL CODES AND ORDINANCES PERTAINING TO THE WORK WITHIN THIS PROJECT.
H ALL EXTERIOR LIGHTING SHALL BE CONTROLLED BY BOTH PHOTOCELL AND PROGRAMMABLE TIME CLOCK.
I ALL SITE LIGHTING AND RECEPTACLE BRANCH CIRCUITS UNDERGROUND SHALL BE A MINIMUM 2#10 & #10G IN 1" SCHEDULE 80 PVC CONDUIT UNLESS OTHERWISE NOTED.
J COORDINATE FINAL LOCATION AND ALL ASSOCIATED WORK OF UTILITY TRANSFORMER WITH CIVIL CONSULTANT DRAWINGS AND LOCAL ELECTRIC UTILITY.

SHEET KEYNOTES

1 PROVIDE FINAL SINGLE POINT CONNECTION TO CHILLER. SEE ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.
2 PROVIDE NEW SECONDARY CONDUCTORS UNDERGROUND IN SCHEDULE 80 PVC CONDUIT TO NEW SWITCHBOARD 'MDP' IN MECH. 148 AS INDICATED ON ONE-LINE DIAGRAM ON SHEET E-901. COORDINATE FINAL ROUTING AND REMOVAL OF EXISTING PARKING LOT REMOVAL WITH CIVIL PLANS.
3 NEW PAD MOUNTED UTILITY TRANSFORMER. PROVIDE NEW CONCRETE PAD AS REQUIRED AND COORDINATE ALL WORK WITH NIPSCO.
4 PROVIDE NEW CT CABINET AND METER ACCORDING TO NIPSCO REQUIREMENTS.



N
1 ELECTRICAL SITE PLAN
1" = 30'-0"

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Fort Wayne, Indiana 46845
260-483-9795

SEAL | DATE 07/24/24

DAVID HERNANDEZ JR. REGISTERED No. 12200632 STATE OF INDIANA PROFESSIONAL ENGINEER

SHEET ISSUE

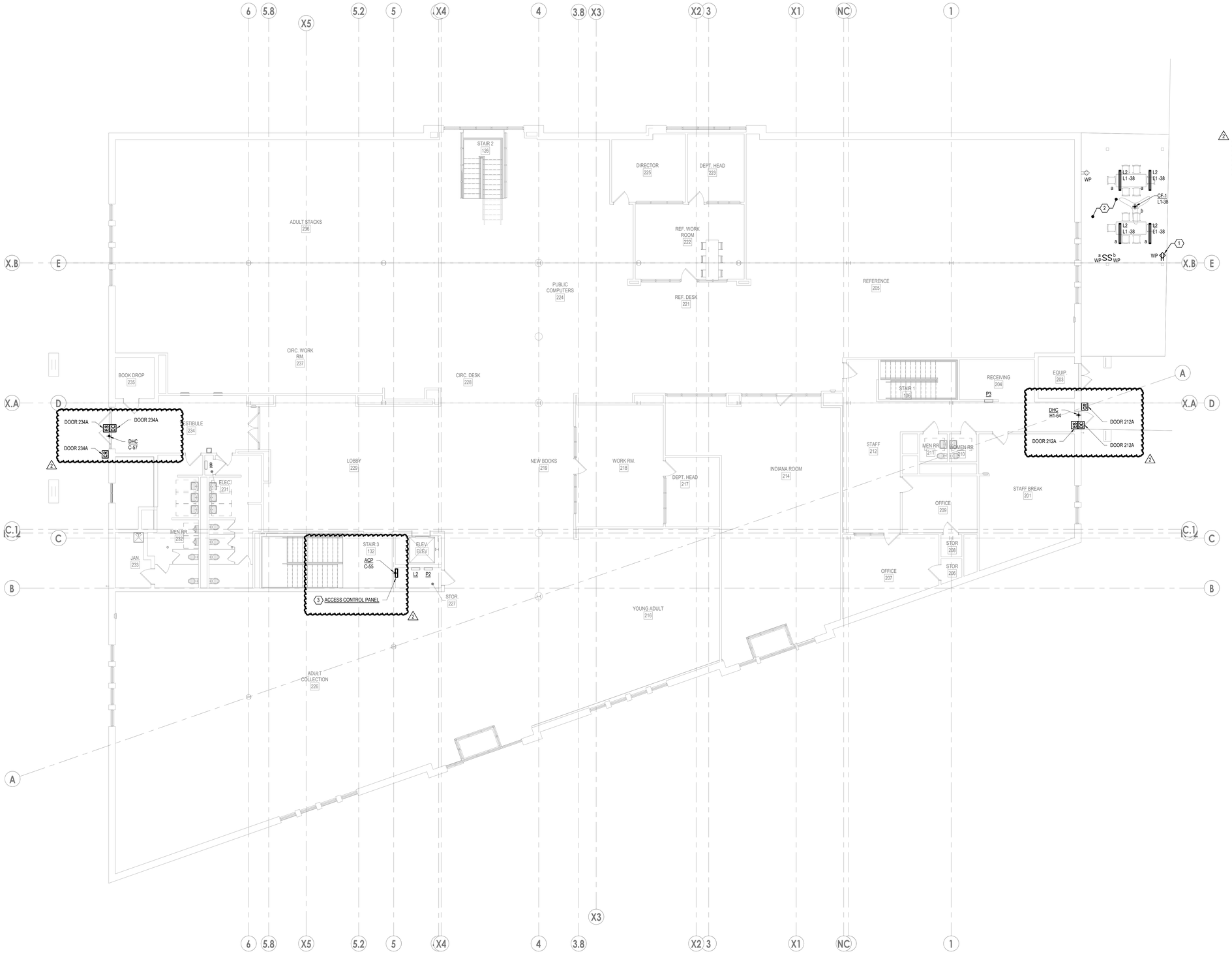
1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
SITE ELECTRICAL PLAN

SHEET NUMBER
ES-002

7/23/2024 12:14:36 PM



N

1 FIRST FLOOR ELECTRICAL PLAN

1/8" = 1'-0"

7/23/2024 12:14:34 PM

GENERAL NOTES

A REFER TO SHEET E-000 FOR GENERAL ELECTRICAL NOTES, SYMBOLS AND ABBREVIATIONS.

B REFER TO E-600 SERIES SHEETS FOR PANEL SCHEDULES.

C ALL BREAKERS SERVING FIRE ALARM SYSTEM BRANCH CIRCUITS SHALL BE LOCKABLE IN THE ON POSITION AND MARKED RED.

D REFER TO EQUIPMENT ELECTRICAL CONNECTIONS SCHEDULE ON E-600 SERIES SHEETS FOR ADDITIONAL INFORMATION.

SHEET KEYNOTES

1 PROVIDE NEW DUPLEX RECEPTACLE IN WEATHERPROOF IN-USE COVER. CONNECT TO EXISTING LOCAL WEATHERPROOF EXTERIOR RECEPTACLE CIRCUIT. ROUTE CIRCUIT UNDERGROUND IN SCHEDULE 40 PVC CONDUITAND UP INSIDE COLUMN OF NEW PAVILION.

2 ALL NEW PAVILION LIGHT FIXTURES SHALL BE CONTROLLED FROM ASTRONOMIC DIGITAL TIME CLOCK AND PHOTOCELL. PROVIDE LOCAL WEATHERPROOF LIGHT SWITCH FOR CONTROL OVERRIDE.

3 PROVIDE DOOR ACCESS CONTROL PANEL, ALL CABLING, AND ACCESSORIES FOR A COMPLETE SYSTEM INSTALLATION ACCORDING TO THE DOOR ACCESS CONTROL SPECIFICATIONS. PROVIDE PLENUM RATED CATEGORY 6A CABLING OR AS REQUIRED FROM DOOR ACCESS CONTROL MANUFACTURER FROM DOOR ACCESS CONTROL PANEL TO DOOR 234A AND DOOR 212A FOR DOOR ACCESS CONTROL.

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SEAL | DATE 07/24/24

DAVID FERNANDEZ JR. REGISTERED No. 12200632 STATE OF INDIANA PROFESSIONAL ENGINEER

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

PROJECT NO. 21730.001

SHEET TITLE
FIRST FLOOR ELECTRICAL PLAN

SHEET NUMBER
E-101

EQUIPMENT ELECTRICAL CONNECTIONS

DEVICE TAG	VOLTAGE	PHASE	MCA	# OF WIRES	WIRE SIZE	GND SIZE	CND SIZE / CABLE TYPE	CONNECTION / RECEPTACLE / DISCONNECT
ACP	120 V	1	4.2	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-1 CHILLER PLAN POD	120 V	1	12	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-1 LIGHTS/RECEPT.	120 V	1	12	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-1 UV LIGHTS	120 V	1	12	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-1-SF-1A	208 V	3	78.2	3	#1	#6	1-1/4"	VFD WITH INTEGRAL DISCONNECT
AHU-1-SF-1B	208 V	3	78.2	3	#1	#6	1-1/4"	VFD WITH INTEGRAL DISCONNECT
AHU-2 & HEATING PLANT DDC PANEL	120 V	1	4	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-2 LIGHTS/RECEPT.	120 V	1	4	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-2 UV LIGHTS	120 V	1	4	2	#12	#12	3/4"	SINGLE POINT CONNECTION
AHU-2-SF-2A	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
AHU-2-SF-2B	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
B-1	208 V	1	20	2	#10	#10	3/4"	NEMA 1 DISCONNECT
B-2	208 V	1	20	2	#10	#10	3/4"	NEMA 1 DISCONNECT
CF-1	120 V	1	1	2	#12	#12	3/4"	SINGLE POINT CONNECTION
CH-1	208 V	3	416	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SINGLE POINT CONNECTION
CH-2	208 V	3	416	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SEE RISER DIAGRAM	SINGLE POINT CONNECTION
CP-1	120 V	1	4.4	2	#12	#12	3/4"	TOGGLE DISCONNECT/MANUAL MOTOR STARTER
CWP-1	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
CWP-2	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
DHC	120 V	1	4.2	2	#12	#12	3/4"	SINGLE POINT CONNECTION
GLYCOL MAKEUP	120 V	1	4.4	2	#12	#12	3/4"	TOGGLE DISCONNECT/MANUAL MOTOR STARTER
H-1	208 V	3	167	3	#4/0	#4	2"	NEMA 1 DISCONNECT
H-2	208 V	3	100	3	#4/0	#4	2"	SINGLE POINT CONNECTION
HCP-1	120 V	1	13	2	#12	#12	3/4"	TOGGLE DISCONNECT/MANUAL MOTOR STARTER
HCP-2	120 V	1	13	2	#12	#12	3/4"	TOGGLE DISCONNECT/MANUAL MOTOR STARTER
HWP-1	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
HWP-2	208 V	3	48.3	3	#6	#10	3/4"	VFD WITH INTEGRAL DISCONNECT
TB TRANSFORMER	120 V	1	4	2	#12	#12	3/4"	TOGGLE DISCONNECT/MANUAL MOTOR STARTER
WH-1	120 V	1	12	2	#12	#12	3/4"	NEMA 5-20R
WS-1A	120 V	1	12	2	#12	#12	3/4"	NEMA 5-20R
WS-1B	120 V	1	12	2	#12	#12	3/4"	NEMA 5-20R

LIGHT FIXTURE SCHEDULE

UNIT ID	DESCRIPTION	DRIVER	VOLTS (V)	LIGHT			LOAD		MOUNTING	MOUNTING HEIGHT (AFF)	MANUFACTURER	EQUAL MANUFACTURERS
				COLOR (K)	QTY (LM)	UNITS	QTY (W)	UNITS				
EM1	THERMOPLASTIC EMERGENCY EGRESS LIGHT, WHIT FINISH, EMERGENCY BATTERY BACKUP.	ELECTRONIC	120	4000			5	/FIXTURE	SURFACE	7'-6"	DUAL LITE EZ-2 LED SERIES	SURE-LITE SEL SERIES LITHONIA ELM4L SERIES
L1	4-FOOT LENSED INDUSTRIAL STRIP, FORMED STEEL HOUSING, CHAIN HUNG, WHITE FINISH, CURVED ACRYLIC DIFFUSER, DLC LISTED	0-10V DIMMING TO 10%	120	4000	6421	/FIXTURE	43	/FIXTURE	CHAIN HUNG/SURFACE	8'-0"	METALUX SNLED SERIES	COLUMBIA MPS SERIES LITHONIA ZL1D SERIES
L2	LINEAR GASKETTED 4-INCH WIDE BY 4-FOOT LONG, FLUSH FROSTED ACRYLIC LENS, ANODIZED FINISH. WET LOCATION LISTED, IP67 RATED.	0-10V DIMMING TO 10%	120	4000	720	/FT	7.1	/FT	SUSPENDED	+96"	AXIS WET BEAM 4 SERIES	VIA WET LED SERIES MARK SLOT 4 SERIES
S1	ARM MOUNT AREA LIGHT, MOUNT ON SQUARE STRAIGHT STEEL POLE, TYPE 4F DISTRIBUTION. COLOR TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S CATALOG OF STANDARD FINISHES.	0-10V DIMMING TO 10%	120	4000	10000	/FIXTURE	72	/FIXTURE	POLE	24'-0"	BEACON VIPER SERIES	LUMARK PREVAIL SERIES LITHONIA DSX1 SERIES
S2	ARM MOUNT AREA LIGHT, MOUNT ON SQUARE STRAIGHT STEEL POLE, TYPE 3 DISTRIBUTION, COLOR TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S CATALOG OF STANDARD FINISHES.	0-10V DIMMING TO 10%	120	4000	10000	/FIXTURE	72	/FIXTURE	POLE	24'-0"	BEACON VIPER SERIES	LUMARK PREVAIL SERIES LITHONIA DSX1 SERIES

Switchboard: MDP

Location: MECH. 148
Supply From:
Mounting: FLOOR
Enclosure: NEMA 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 240kA
Mains Type: MCB
Mains Rating: 2000 A
MCB Rating: 2000 A

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	H1	3	400 A	400 A	88836 VA	
2	P1	3	225 A	200 A	0 VA	
3	L1	3	225 A	225 A	19498 VA	
4	C	3	400 A	400 A	90724 VA	
5	D	3	150 A	150 A	0 VA	
6	F	3	100 A	70 A	0 VA	
7	G	3	225 A	125 A	0 VA	
8	B	3	225 A	225 A	0 VA	
9	L2	3	225 A	225 A	0 VA	
10	P2	3	225 A	225 A	0 VA	
11	P3	3	225 A	225 A	0 VA	
12	CH-1	3	600 A	450 A	149867 VA	
13	CH-2	3	600 A	450 A	149867 VA	
14	H-2	3	150 A	125 A	20800 VA	
15	H-2	3	150 A	125 A	20800 VA	
16	H-1	3	225 A	225 A	60162 VA	
17	H-1	3	225 A	225 A	60162 VA	
18						
19						
20						
				Total Conn. Load:	660715 VA	
				Total Amps:	1834 A	

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
HVAC	616513 VA	100.00%	616513 VA	
LIGHTING	1538 VA	125.00%	1923 VA	**Total Conn. Load:** 660715 VA
Spare	35500 VA	100.00%	35500 VA	**Total Est. Demand:** 661100 VA
RECEPT	4980 VA	100.00%	4980 VA	**Total Conn.:** 1834 A
FRACTIONAL HP MOTOR	2184 VA	100.00%	2184 VA	**Total Est. Demand:** 1835 A

Notes:

Branch Panel: L1

Location: JANITOR 122
Supply From: MDP
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10kA
Mains Type: MLO
Mains Rating: 225 A

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	LIGHTS E BKS	20 A	1	500	500					1	20 A	LIGHTS AV PASSAGE	2
3	LIGHTS E BKS	20 A	1			500	500			1	20 A	LTS CRAFT RM/STORAGE/STOR HR	4
5	LIGHTS C CIRC DESK	20 A	1					500	500	1	20 A	LTS PUPPET RM/STORY HR RECESS	6
7	LIGHTS J BKS	20 A	1	500	500					1	20 A	LTS-ELEV EOT/BRR/GRR	8
9	LIGHTS J BKS	20 A	1			500	500			1	20 A	LIGHTS - SCHROCK	10
11	LIGHTS J BKS	20 A	1					500	500	1	20 A	LIGHTS - SCHROCK	12
13	LIGHTS LOBBY	20 A	1	500	500					1	20 A	LIGHTS - SCHROCK	14
15	SOFFIT LIGHTS	20 A	1			500	500			1	20 A	LIGHTS - SCHROCK	16
17	LIGHTS - AV COLL	20 A	1					500	500	1	20 A	LIGHTS - SCHROCK	18
19	LIGHTS - AV COLL	20 A	1	500	500					1	20 A	LIGHTS - SCHROCK	20
21	LIGHTS MT RM AB	20 A	1			500	500			1	20 A	LIGHTS - SCHROCK	22
23	LTS/ST COM/PACK/UNPACK/MAG ST	20 A	1					500	500	1	20 A	LIGHTS - FRIENDS	24
25	LIGHTS - FUTURE EXP & HALLWAY	20 A	1	500	500					1	20 A	TRACK LIGHT	26
27	LTS-CH COMPUTER/CH WK ROOM	20 A	1			500	500			1	20 A	TRACK LIGHT	28
29	LIGHTS - JAN WKSHOP	20 A	1					500	500	1	20 A	TRACK LIGHT	30
31	LIGHTS - ELEVATOR CAR	20 A	1	500	500					1	20 A	PARKING LOT LIGHTS TIMER POWER	32
33	TRACK LIGHT	20 A	1			500	500			1	20 A	NORTH PARKING LOT LIGHTS	34
35	TRACK LIGHT	20 A	1					500	500	1	20 A	NORTH PARKING LOT LIGHTS	36
37	SPARE	20 A	1	0	498					1	20 A	SOUTH PARKING LOT & PAVILION LIGHTS	38
39	SPARE	20 A	1			0	500			1	20 A	TRACK LIGHT	40
41	SPARE	20 A	1					0	500	1	20 A	STORAGE LOCKER	42
		Total Load:		6498 VA		6500 VA		6500 VA					
		Total Amps:		54 A		54 A		54 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
LIGHTING	498 VA	125.00%	623 VA	
Spare	19000 VA	100.00%	19000 VA	**Total Conn. Load:** 19498 VA
				Total Est. Demand: 19623 VA
				Total Conn.: 54 A
				Total Est. Demand: 54 A

Notes:
EXISTING SQUARE D NQ PANEL. PROVIDE NEW BREAKERS FOR ALL NEW CIRCUITS.

Branch Panel: C

Location: MECH. 148
Supply From: MDP
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22kA
Mains Type: MLO
Mains Rating: 400 A

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	SPARE	20 A	1	0	500					1	20 A	JOHNSON CONTROLS CONTROL PANEL	2
3	IN-LINE CIRC PUMP	20 A	1			0	0			2	20 A	SPARE	4
5	RECEPT. UNDER BOILER CONT.	20 A	1					0	0				6
7				5800	5800								8
9	HWP-1	90 A	3			5800	5800			3	90 A	AHU-2-SF-2A	10
11								5800	5800				12
13				500	5800								14
15	SUMP PUMP #3	20 A	3			500	5800			3	90 A	HWP-2	16
17								500	5800				18
19				5800	500					2	30 A	OLD SEWAGE PUMPS	20
21	AHU-2-SF-2B	90 A	3			5800	500						22
23								5800	500	1	20 A	KITCHEN REFRIGERATOR RECEPT.	24
25	SPACE	--	1	--	--					1	--	SPACE	26
27	SPACE	--	1			--	--			1	--	SPACE	28
29	SPACE	--	1					--	--	1	--	SPACE	30
31	UPS PHONE RECEPT.	20 A	1	500	500								32
33	B-1	25 A	2			2080	500			3	30 A	SUMP PUMP #4	34
35								2080	500				36
37	B-2	25 A	2	2080	500					1	20 A	TB TRANSFORMER	38
39						2080	500			1	20 A	AHU-2 & HEATING PLANT DDC PANEL	40
41	HCP-2	20 A	1					1656	0	1	20 A	SPARE	42
43	AHU-2 LIGHTS/RECEPT.	20 A	1	180	0					1	20 A	SPARE	44
45	AHU-2 UV LIGHTS	20 A	1			500	0			1	20 A	SPARE	46
47	CP-1	20 A	1					528	0	1	20 A	SPARE	48
49	WH-1	20 A	1	1440	0					1	20 A	SPARE	50
51	WS-1A	20 A	1			500	0			1	20 A	SPARE	52
53	WS-1B	20 A	1					500	0	1	20 A	SPARE	54
55	ACP	20 A	1	500	0					1	20 A	SPARE	56
57	DHC	20 A	1			500	0			1	20 A	SPARE	58
59	SPARE	20 A	1					0	0	1	20 A	SPARE	60
61	SPARE	20 A	1	0	0					1	20 A	SPARE	62
63	SPARE	20 A	1			0	0			1	20 A	SPARE	64
65	SPARE	20 A	1					0	0	1	20 A	SPARE	66
67	SPARE	20 A	1	0	0					1	20 A	SPARE	68
69	SPARE	20 A	1			0	0			1	20 A	SPARE	70
71	SPARE	20 A	1					0	0	1	20 A	SPARE	72
		Total Load:		30400 VA		30860 VA		29464 VA					
		Total Amps:		255 A		258 A		246 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
HVAC	78420 VA	100.00%	78420 VA	
LIGHTING	680 VA	125.00%	850 VA	**Total Conn. Load:** 90724 VA
Spare	5500 VA	100.00%	5500 VA	**Total Est. Demand:** 90894 VA
RECEPT	3940 VA	100.00%	3940 VA	**Total Conn.:** 252 A
FRACTIONAL HP MOTOR	2184 VA	100.00%	2184 VA	**Total Est. Demand:** 252 A

Notes:
EXISTING PANEL TO BE REPLACED WITH NEW. SEE ONE-LINE DIAGRAMS FOR ADDTIONAL INFORMATION.

Branch Panel: H1

Location:
Supply From: MDP
Mounting: SURFACE
Enclosure: NEMA 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22kA
Mains Type: MLO
Mains Rating: 400 A
MCB Rating: 400 A

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	SPARE	20 A	1	0	0					1	20 A	SPARE	2
3	SPARE	20 A	1			0	0			1	20 A	SPARE	4
5	SPARE	20 A	1					0	0	1	20 A	SPARE	6
7	BOOK LIFT LIGHT	20 A	1	500	500								8
9	SPARE	20 A	1			0	500			3	60 A	CONDENSING UNIT	10
11	SPARE	20 A	1					0	500				12
13	RECEPTS. S. MECH ROOM	20 A	1	500	500					1	20 A	TEMP CONTROL PANEL	14
15	RECEPTS. FUTURE EXP	20 A	1			500	500						16
17	RECEPTS. FUTURE EXP	20 A	1					500	500	3	20 A	SUMP PUMP #2	18
19	RECEPTS. JAN WKSHOP & CLST	20 A	1	500	500								20
21	SIMPLEX PANEL	20 A	1			500	500						22
23								500	500	3	35 A	BOOK LIFT	24
25	AIR COMPRESSOR	20 A	3	500	500								26
27						500	500						28
29	UNIT HEATER	20 A	1					500	500	3	30 A	SUMP PUMP #1	30
31	SPARE	20 A	1	0	0								32
33	SPARE	20 A	1			0	0						34
35	SPARE	20 A	1					0	0	3	40 A	SPARE	36
37	SPARE	20 A	1	0	0								38
39	SPARE	20 A	1			0	0			1	20 A	SPARE	40
41	SPARE	20 A	1					0	0	1	20 A	SPARE	42
43	AHU-SF-1A	110 A	3	9391	9391								44
45						9391	9391			3	110 A	AHU-SF-1B	46
47								9391	9391				48
49	AHU-SF-1A SPACE	--	3	--	--								50
51						--	--			3	--	AHU-SF-1B SPACE	52
53								--	--				54
55	CWP-1	90 A	3	3349	3349								56
57						3349	3349			3	90 A	CWP-2	58
59								3349	3349				60
61	AHU-1 LIGHTS/RECEPT.	20 A	1	180	180					1	20 A	CHILLER RECEPT.	62
63	AHU-1 UV LIGHTS	20 A	1			180	500			1	20 A	DHC	64
65	AHU-1 & CHILLER PLAN DDC PANEL	20 A	1					180	0	1	20 A	SPARE	66
67	HCP-1	20 A	1	0	0					1	20 A	SPARE	68
69	GLYCOL MAKEUP	20 A	1			180	0			1	20 A	SPARE	70
71	SPARE	20 A	1					0	0	1	20 A	SPARE	72
		Total Load:		29839 VA		29839 VA		29159 VA					
		Total Amps:		250 A		250 A		243 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
HVAC	76436 VA	100.00%	76436 VA	
LIGHTING	360 VA	125.00%	450 VA	**Total Conn. Load:** 88836 VA
Spare	11000 VA	100.00%	11000 VA	**Total Est. Demand:** 88926 VA
RECEPT	1040 VA	100.00%	1040 VA	**Total Conn.:** 247 A
FRACTIONAL HP MOTOR	0 VA	0.00%	0 VA	**Total Est. Demand:** 247 A

Notes:
EXISTING PANEL TO BE REPLACED WITH NEW. SEE ONE-LINE DIAGRAMS FOR ADDTIONAL INFORMATION.

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SEAL | DATE 07/24/24

DAVID HERNANDEZ JR. REGISTERED No. 12200632 STATE OF INDIANA PROFESSIONAL ENGINEER

SHEET ISSUE

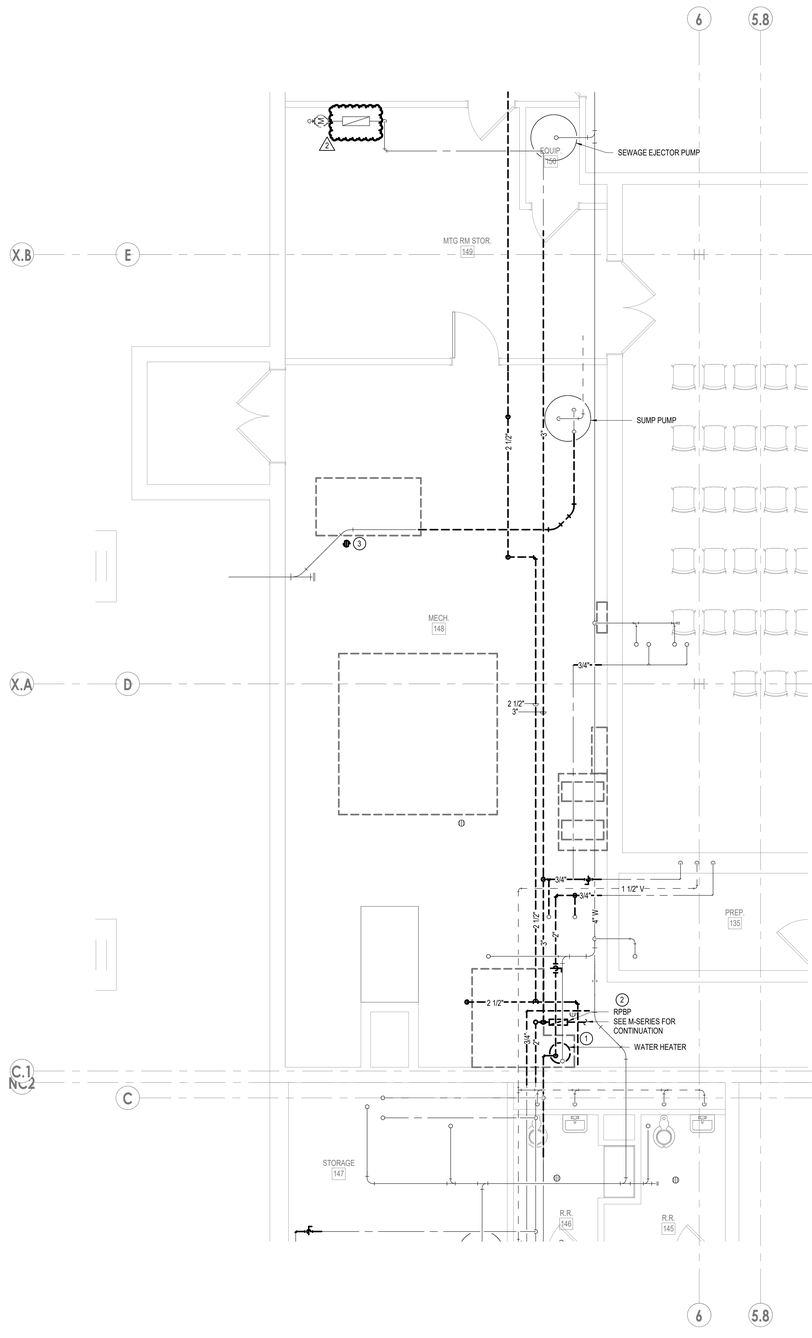
1	**PERMIT SET**	**06/27/24**
2	**ADDENDUM 1**	**07/24/24**

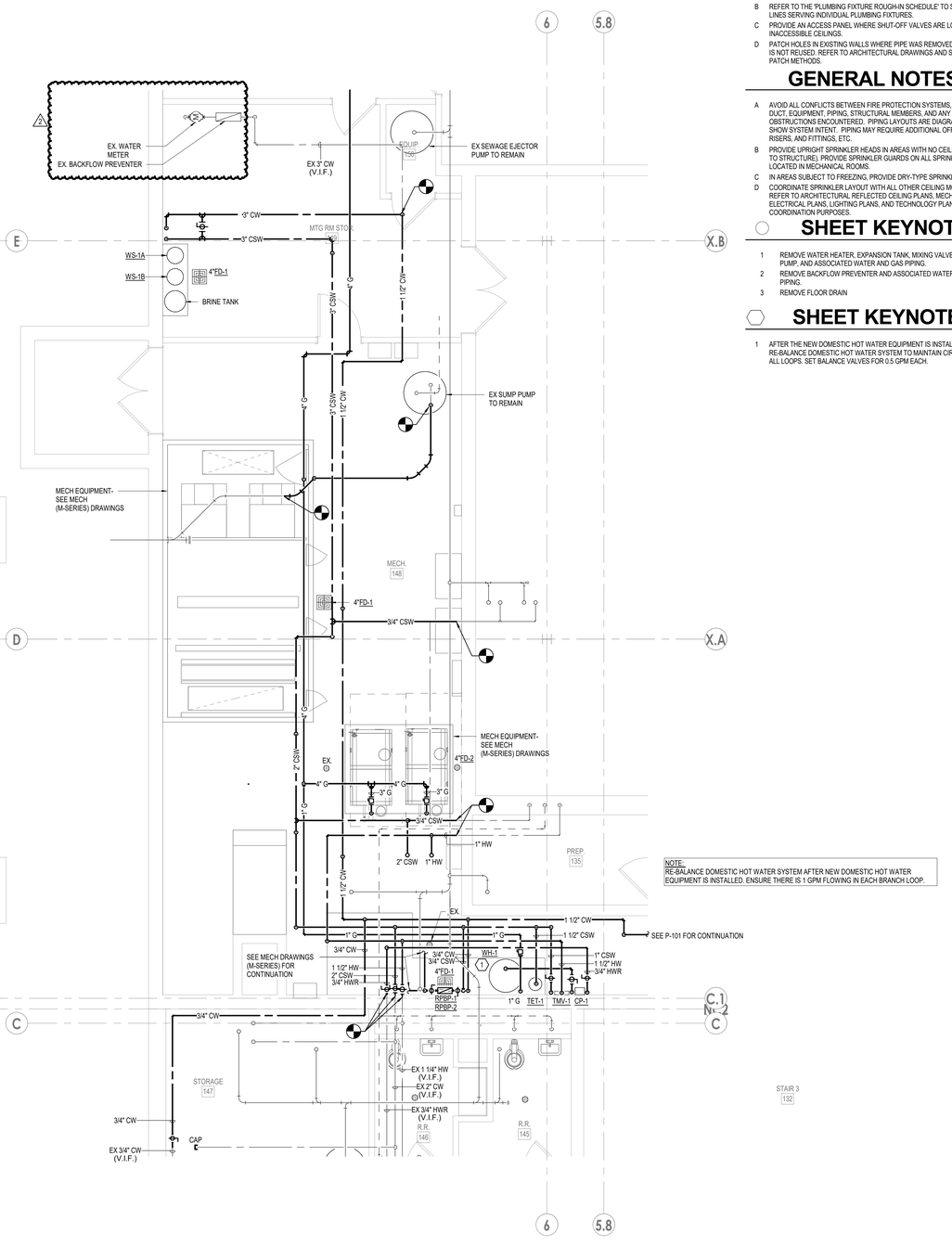
PROJECT NO. 21730.001

SHEET TITLE
ELECTRICAL SCHEDULES

SHEET NUMBER
E-601

7/23/2024 12:14:35 PM





N

2 NORTH MECHANICAL ROOM DEMOLITION PLUMBING PLAN

1/4" = 1'-0"

N

1 NORTH MECHANICAL ROOM PLUMBING PLAN

1/4" = 1'-0"

GENERAL NOTES

A AVOID ALL CONFLICTS BETWEEN PLUMBING SYSTEMS, AND CONDUIT, DUCT, EQUIPMENT, PIPING, STRUCTURAL MEMBERS, AND ANY OTHER OBSTRUCTIONS ENCOUNTERED. PIPING LAYOUTS ARE DIAGRAMMATIC AND SHOW SYSTEM INTENT. PIPING MAY REQUIRE ADDITIONAL OFFSETS, DROPS, RISERS, AND FITTINGS, ETC.

B REFER TO THE 'PLUMBING FIXTURE ROUGH-IN SCHEDULE' TO SIZE BRANCH LINES SERVING INDIVIDUAL PLUMBING FIXTURES.

C PROVIDE AN ACCESS PANEL WHERE SHUT-OFF VALVES ARE LOCATED ABOVE INACCESSIBLE CEILINGS.

D PATCH HOLES IN EXISTING WALLS WHERE PIPE WAS REMOVED AND THE HOLE IS NOT REUSED. REFER TO ARCHITECTURAL DRAWINGS AND SPECS FOR PATCH METHODS.

GENERAL NOTES

A AVOID ALL CONFLICTS BETWEEN FIRE PROTECTION SYSTEMS, AND CONDUIT, DUCT, EQUIPMENT, PIPING, STRUCTURAL MEMBERS, AND ANY OTHER OBSTRUCTIONS ENCOUNTERED. PIPING LAYOUTS ARE DIAGRAMMATIC AND SHOW SYSTEM INTENT. PIPING MAY REQUIRE ADDITIONAL OFFSETS, DROPS, RISERS, AND FITTINGS, ETC.

B PROVIDE UPRIGHT SPRINKLER HEADS IN AREAS WITH NO CEILINGS (EXPOSED TO STRUCTURE); PROVIDE SPRINKLER GUARDS ON ALL SPRINKLERS LOCATED IN MECHANICAL ROOMS.

C IN AREAS SUBJECT TO FREEZING, PROVIDE DRY-TYPE SPRINKLER HEADS.

D COORDINATE SPRINKLER LAYOUT WITH ALL OTHER CEILING MOUNTED ITEMS. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS, MECHANICAL PLANS, ELECTRICAL PLANS, LIGHTING PLANS, AND TECHNOLOGY PLANS FOR COORDINATION PURPOSES.

SHEET KEYNOTES

1 REMOVE WATER HEATER, EXPANSION TANK, MIXING VALVE, CIRCULATOR PUMP, AND ASSOCIATED WATER AND GAS PIPING.

2 REMOVE BACKFLOW PREVENTER AND ASSOCIATED WATER AND DRAIN PIPING.

3 REMOVE FLOOR DRAIN

SHEET KEYNOTES

1 AFTER THE NEW DOMESTIC HOT WATER EQUIPMENT IS INSTALLED, RE-BALANCE DOMESTIC HOT WATER SYSTEM TO MAINTAIN CIRCULATION IN ALL LOOPS. SET BALANCE VALVES FOR 0.5 GPM EACH.

GOSHEN PUBLIC LIBRARY

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SEAL | DATE 07/24/24

JOHN ALLEN WOODROUGH REGISTERED No. PE11300620 STATE OF INDIANA PROFESSIONAL ENGINEER

John Allen Woodrough

SHEET ISSUE

1	PERMIT SET	06/27/24
2	ADDENDUM 1	07/24/24

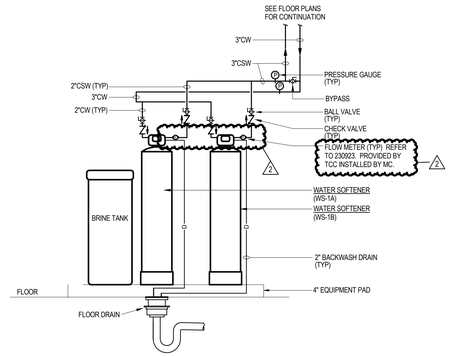
RATIO

PROJECT NO. 21730.001

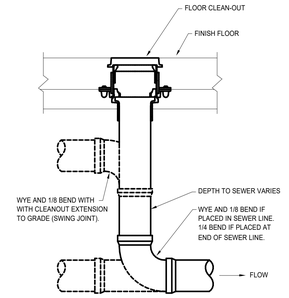
SHEET TITLE
NORTH MECHANICAL ROOM PLUMBING ENLARGED PLAN

SHEET NUMBER
P-402

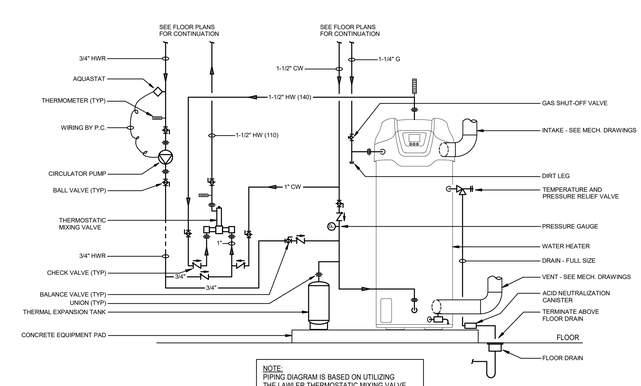
7/23/2024 12:48:39 PM



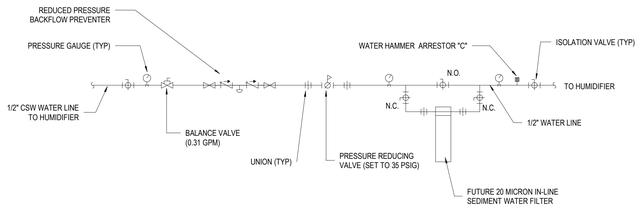
4 WATER SOFTENER PIPING DETAIL
NOT TO SCALE



3 INTERIOR CLEANOUT DETAIL
NOT TO SCALE



2 DOMESTIC WATER HEATING EQUPMENT PIPING DETAIL
NOT TO SCALE



1 HUMIDIFICATION WATER SUPPLY PIPING DETAIL
NOT TO SCALE

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SHEET ISSUE

1	**PERMIT SET**	**06/27/24**
2	**ADDENDUM 1**	**07/24/24**

PROJECT NO. 21730.001

SHEET TITLE
PLUMBING DETAILS

SHEET NUMBER
P-501

7/23/2024 2:52:29 PM