# ADDENDUM NO. 1

**October 8, 2024**

**Kalamazoo Public Schools**
**District Kitchen**
**6750 Chime Street**
**Kalamazoo, MI 49009**

## TO: ALL BIDDERS OF RECORD

This Addendum forms a part of and modifies the Bidding Requirements, Contract Forms, Contract Conditions, the Specifications, and the Drawings dated September 20, 2024, by TowerPinkster. Acknowledge receipt of the Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of Pages ADD 1-7 and TowerPinkster Addendum No. 01, dated October 7, 2024, consisting of 112 pages.

**A. SPECIFICATION SECTION 00 20 00 – INFORMATION AVAILABLE TO BIDDERS**

1. Refer to Part C. Delete this section in its entirety.
2. Refer to Part D. Delete this section in its entirety.
3. Add Part E. Refer to the attached Site Logistics Plan dated October 4, 2024.

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

**Paragraph 3.03 BID CATEGORIES**

**A. BID CATEGORY NO. 1 – SITEWORK**

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize submittals in a manner to meet Schedule requirements.
2. Provide all Site Clearing and site demolition as required to facilitate new work, refer to sheet C100 for reference of demolition and removals. Verify existing field conditions prior to proceeding with removals. Implement, maintain, and remove SESC measures as

required, specified, and shown.

3. Provide, maintain, and remove at the end of construction a, (+/- 20'wide by 60' long) aggregate/stone construction access and egress drive for the duration of construction. Refer to the Site Logistics Plan issued in Addendum No. 1.
4. Provide protection to existing pavements, walks, and site conditions scheduled to remain. Provide street sweeping/cleaning of Chime and Erie Street to maintain adjacent public streets/roads in acceptable and clean condition. Include a minimum of eight (8) intervals of street sweeping and cleaning.
5. Provide all Earth Moving work, including material and excavation, grading, compacting, & backfilling as required for all Concrete Work, including but not limited to concrete footings, foundations, stoops, curbs, gutters, walks, drives, and building slab on grade concrete, coordinate this Work with **Bid Category No. 3 Concrete**.
6. Provide all Site Utilities, including storm sewers, sanitary sewers, utility line cleanouts with concrete, and water main work. Coordinate all new Work and connections to existing municipal systems with Municipality, include all required permits, inspections, and testing as required for a completed assembly and a completed system. Reference General Utility notes on C series drawings along with technical specification requirements.
7. Provide the Pre-Cast Polymer Trench Drain outside loading dock as shown on C401 and detailed on sheet C500. Coordinate installation with **Bid Category No. 3 Concrete**.
8. Provide roof drain connections at the perimeter of the building. Refer to C401 and P00. **Bid Category No. 13 Mechanical & Plumbing** shall provide a minimum of 5' pipe/stub, with temporary location marker outside the building for connection.

## B. BID CATEGORY NO. 2 ASPHALT PAVING

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize submittals in a manner to meet Schedule requirements.
2. Provide all asphalt paving markings as shown and specified.

## C. BID CATEGORY NO. 3 CONCRETE

Add the following Section

03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize submittals in a manner to meet Schedule requirements.
2. Provide Thermoplastic sleeves over the Metal Bollards and install all Metal Bollards**. Bid Category No. 7, Structural & Miscellaneous Steel** shall furnish the Metal Bollards.
3. Provide all concrete reinforcement, for all Concrete Work.

4. Provide all related concrete products such as forms, reinforcement accessories, admixtures, water stops, vapor retarders, floor slab treatments, and curing materials.
5. Provide Thermoplastic sleeves over the Metal Bollards and install all Metal Bollards. **Bid Category No. 7, Structural & Miscellaneous Steel** shall furnish the Metal Bollards.
6. Provide all concrete and work for the Cooler and Freezer concrete slab. Refer to A422, detail 1, include all vapor barriers, bond breakers, rigid insulation, mastics, adhesives and 2X continuous blocking for the freezer cooler.
7. Provide all interior and exterior concrete housekeeping and equipment pads as shown and referenced. Coordinate sizes, locations, and specific requirements with Mechanical/Plumbing, Electrical and any other Bid Category Contractor(s). Any housekeeping/equipment pads required but NOT shown on the drawings shall be provided by Contractor requiring such pad(s).
8. Provide all rigid insulation for concrete foundations and under concrete slabs.
9. Provide Concrete Maintenance Strip assembly.
10. Install 6" concrete filled Steel Post Door Support(s) for the Dumpster Enclosure Gate Assembly. Steel Post Door Support(s) for the Dumpster Enclosure Gate Assembly will be furnished by **Bid Category No. 7 Structural & Miscellaneous Steel.**

## D. BID CATEGORY NO.4 MASONRY

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarification
1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide all thermally broken brackets such as Ferro Fast masonry shelf angles/brackets, reference S005 for additional information.
3. Provide all Air Barriers, Rigid Insulation, Brick Vents & Drainage Assemblies, Weeps, Flexible Membrane Flashings, and Flashings for Masonry Work.
4. Provide all grouting work for your wall assemblies and connections, including bond beams and fully grouted bond beam at connection to Pre-Cast Concrete Planks. Reference sheet A322.

## E. BID CATEGORY NO. 05 PRE CAST CONCRETE

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications
1.The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize

their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide all grout for a complete assembly and installation.

## F. BID CATEGORY No. 06 GENERAL TRADES

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarification
1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide all Post Panel and Site Signs, refer to L001, C200 and detail on C501.
3. Refer to Section 01 57 60 Project Signs. The Owner through Skillman will furnish the required Project Signs. The General Trades Contractor shall install, maintain, and remove Project Signs as directed by Skillman.
4. Provide Reception Desk in its entirety. Refer to sheet A641.

## G. BID CATEGORY No. 7 STRUCTURAL & MISCELLANEOUS STEEL

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications
1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide steel guardrail system complete. Refer to sheet A101 and detail 3 on A422 for required fabrication, plate, and anchorage on top of foundation wall including providing and welding the #4 Hairpin Rebar to the posts for concrete embedment.
3. Furnish Metal Bollards to Bid Category No. 3 Concrete Contractor.
4. Provide all miscellaneous fasteners, adhesives, and grout for your work.
5. Provide all fabricated steel ladders, brackets, and fasteners.
6. Provide the Dumpster Enclosure Gate Assembly complete, include all Steel Supports, Hinges, Metal Decking, Hardware, Pin Drops, Square Stock, and Metal Trim. Refer to Section 05 5000 Metal Fabrication and Addendum No. 1 drawings/details for additional information. **Bid Category No. 3 Concrete** will install the 6" concrete filled Steel Post Door Support(s) for Dumpster Enclosure Gate furnished Bid Category No. 7.

## H. BID CATEGORY No. 08 ROOFING

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarification

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.

## I. BID CATEGORY No. 09 ALUMINUM ENTRANCES, STOREFRONTS & WINDOWS

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.

## J. BID CATEGORY No. 10 INTERIOR FINISHES

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide all Top of Wall rating assembly work, all Penetration Firestopping, and all Joint Firestopping work. Refer to G101 for wall ratings and code compliance requirements along with respective technical specificaiton Sections 07 84 13, 07 84 43 and MEPT series drawings for comprehensive understanding of requirements for a complete and code compliant assemblies.

## K. BID CATEGORY No. 11 FLOORING

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. In reference to flooring SV-1, Contractor shall ensure Protect All Flooring Manufacturer representative will participate in Pre-Installation Conference, perform at least 2

inspections during SV-1 installation and at least 1 final inspection, including field reports as a QA/QC program for a compliant SV-1 flooring installation.

## L. BID CATEGORY No. 12 FIRE PROTECTION

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.

## M. BID CATEGORY No. 13 MECHANICAL

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.

## N. BID CATEGORY No. 14 ELECTRICAL

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide all concrete Light Pole Bases for a complete assembly and installation.
3. Provide all site electrical pull boxes, conduits, and new Electrical service and new equipment work for the new Transformer, Generator. Refer to ES101, coordinate with utility service providers and municipalities as required.

**O**. **Bid CATEGORY NO. 15-TECHNOLOGY**

Add the following Section
03 60 00 Post Installed Anchors

Add the following Clarifications

1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.
2. Provide the WAN fiber for a complete assembly and installation.

**P**. **Bid CATEGORY NO. 1- FOOD SERVICE EQUIPMENT**

Add the following Clarifications

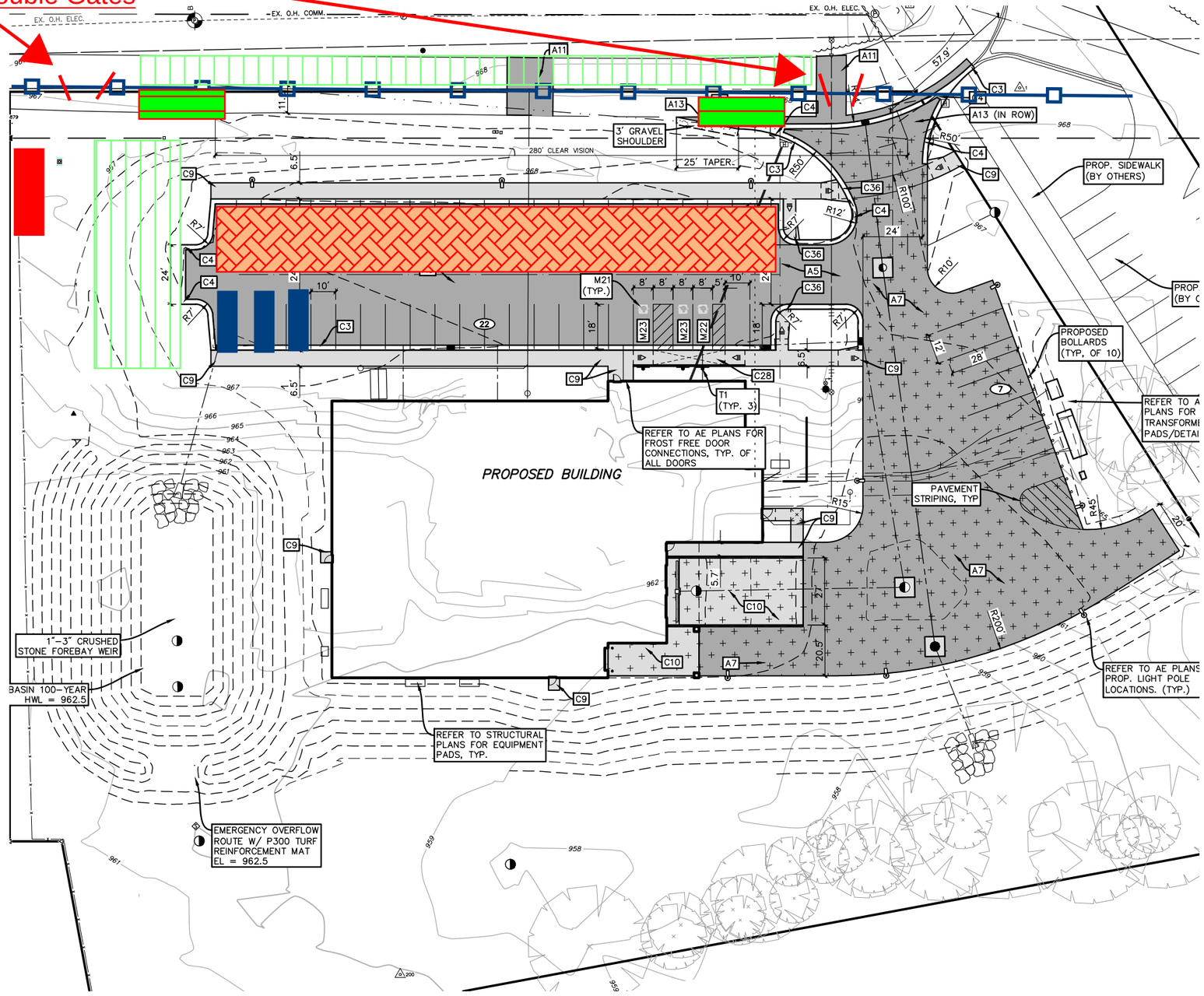
1. The expediting of submittals and shop drawings is critical for Contractors to meet material delivery requirements and adherence to Schedule. Contractors must process and prioritize their submittals in a manner to adhere to the Project Schedule and have all Submittals completed as outlined on the Schedule.

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

**Part 1.03 GUIDELINE SCHEDULE**
**Add:**
A. 3. Refer to the attached Guideline Schedule dated October 8, 2024.

**D. Refer to the attached Pre-Bid Request For Information Log dated October 8, 2024.**

1. RFI No. 01 through 07 are included.




# KALAMAZOO PUBLIC SCHOOLS
## DISTRICT KITCHEN

Legend:

- -Material Lay-Down Area
- -Construction Dumpsters
- -Contractor Parking
- -Project Signage
- -Skillman Office Trailer
- -Temporary Fencing

Kalamazoo Public Schools
Every child. Every opportunity. Every time.

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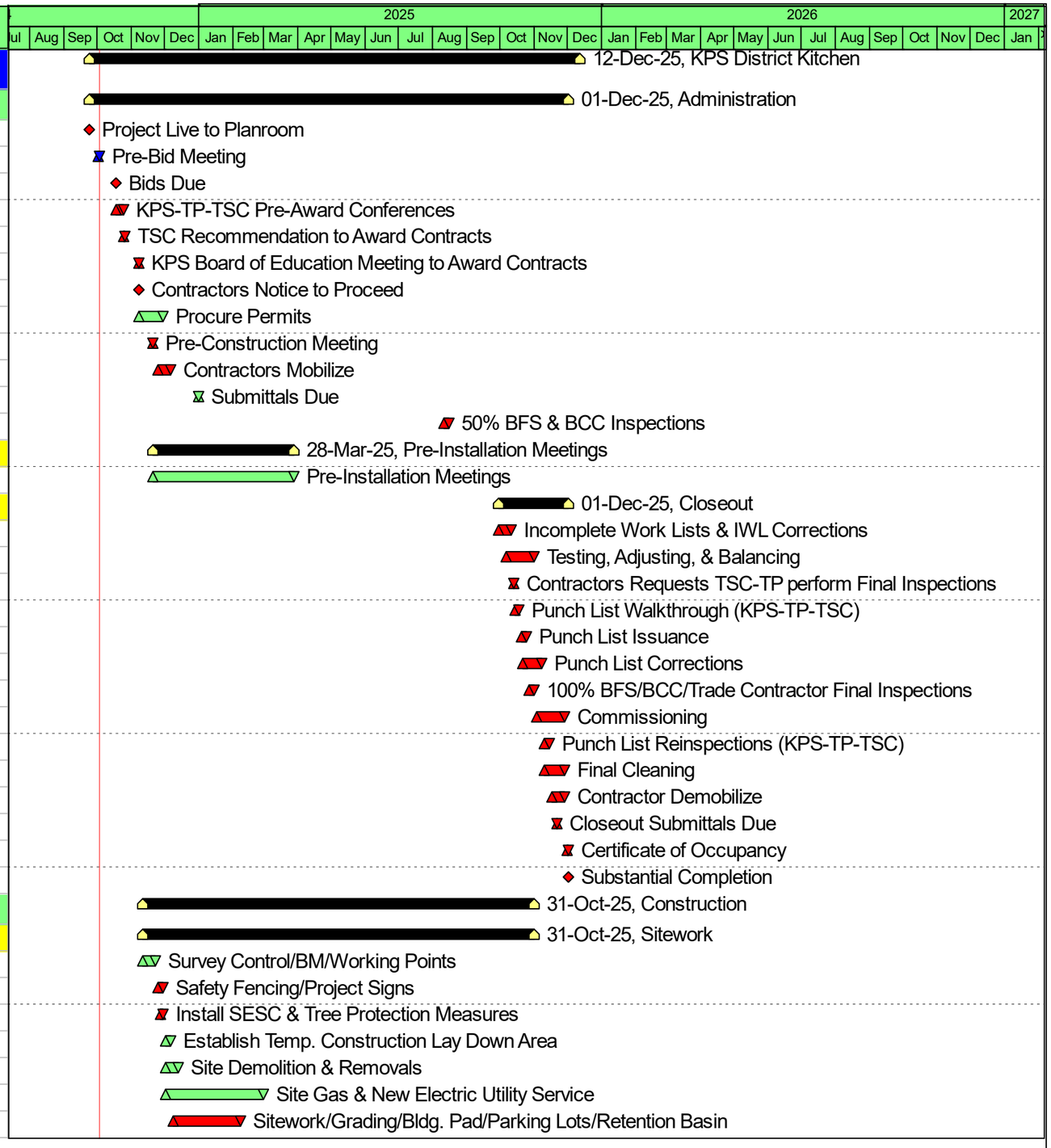
SKILLMAN

## SITE LOGISTICS PLAN - 10/4/24

| Activity Name | Original Duration | Start | Finish |
|---|---|---|---|
| **KPS District Kitchen** | 312 | 23-Sep-24 A | 12-Dec-25 |
| **Administration** | 303 | 23-Sep-24 A | 01-Dec-25 |
| Project Live to Planroom | 0 | 23-Sep-24 A | |
| Pre-Bid Meeting | 1 | 02-Oct-24 A | 02-Oct-24 A |
| Bids Due | 0 | | 17-Oct-24 |
| KPS-TP-TSC Pre-Award Conferences | 5 | 18-Oct-24 | 24-Oct-24 |
| TSC Recommendation to Award Contracts | 1 | 25-Oct-24 | 25-Oct-24 |
| KPS Board of Education Meeting to Award Contracts | 1 | 07-Nov-24 | 07-Nov-24 |
| Contractors Notice to Proceed | 0 | 08-Nov-24 | |
| Procure Permits | 16 | 08-Nov-24 | 29-Nov-24 |
| Pre-Construction Meeting | 1 | 20-Nov-24 | 20-Nov-24 |
| Contractors Mobilize | 10 | 25-Nov-24 | 06-Dec-24 |
| Submittals Due | 1 | 31-Dec-24 | 31-Dec-24 |
| 50% BFS & BCC Inspections | 5 | 11-Aug-25 | 15-Aug-25 |
| **Pre-Installation Meetings** | 93 | 20-Nov-24 | 28-Mar-25 |
| Pre-Installation Meetings | 93 | 20-Nov-24 | 28-Mar-25 |
| **Closeout** | 46 | 29-Sep-25 | 01-Dec-25 |
| Incomplete Work Lists & IWL Corrections | 10 | 29-Sep-25 | 10-Oct-25 |
| Testing, Adjusting, & Balancing | 20 | 06-Oct-25 | 31-Oct-25 |
| Contractors Requests TSC-TP perform Final Inspections | 1 | 13-Oct-25 | 13-Oct-25 |
| Punch List Walkthrough (KPS-TP-TSC) | 4 | 14-Oct-25 | 17-Oct-25 |
| Punch List Issuance | 5 | 20-Oct-25 | 24-Oct-25 |
| Punch List Corrections | 14 | 21-Oct-25 | 07-Nov-25 |
| 100% BFS/BCC/Trade Contractor Final Inspections | 5 | 27-Oct-25 | 31-Oct-25 |
| Commissioning | 20 | 03-Nov-25 | 28-Nov-25 |
| Punch List Reinspections (KPS-TP-TSC) | 5 | 10-Nov-25 | 14-Nov-25 |
| Final Cleaning | 15 | 10-Nov-25 | 28-Nov-25 |
| Contractor Demobilize | 10 | 17-Nov-25 | 28-Nov-25 |
| Closeout Submittals Due | 1 | 21-Nov-25 | 21-Nov-25 |
| Certificate of Occupancy | 1 | 01-Dec-25 | 01-Dec-25 |
| Substantial Completion | 0 | | 01-Dec-25 |
| **Construction** | 255 | 11-Nov-24 | 31-Oct-25 |
| **Sitework** | 255 | 11-Nov-24 | 31-Oct-25 |
| Survey Control/BM/Working Points | 10 | 11-Nov-24 | 22-Nov-24 |
| Safety Fencing/Project Signs | 5 | 25-Nov-24 | 29-Nov-24 |
| Install SESC & Tree Protection Measures | 3 | 27-Nov-24 | 29-Nov-24 |
| Establish Temp. Construction Lay Down Area | 5 | 02-Dec-24 | 06-Dec-24 |
| Site Demolition & Removals | 10 | 02-Dec-24 | 13-Dec-24 |
| Site Gas & New Electric Utility Service | 65 | 02-Dec-24 | 28-Feb-25 |
| Sitework/Grading/Bldg. Pad/Parking Lots/Retention Basin | 45 | 09-Dec-24 | 07-Feb-25 |



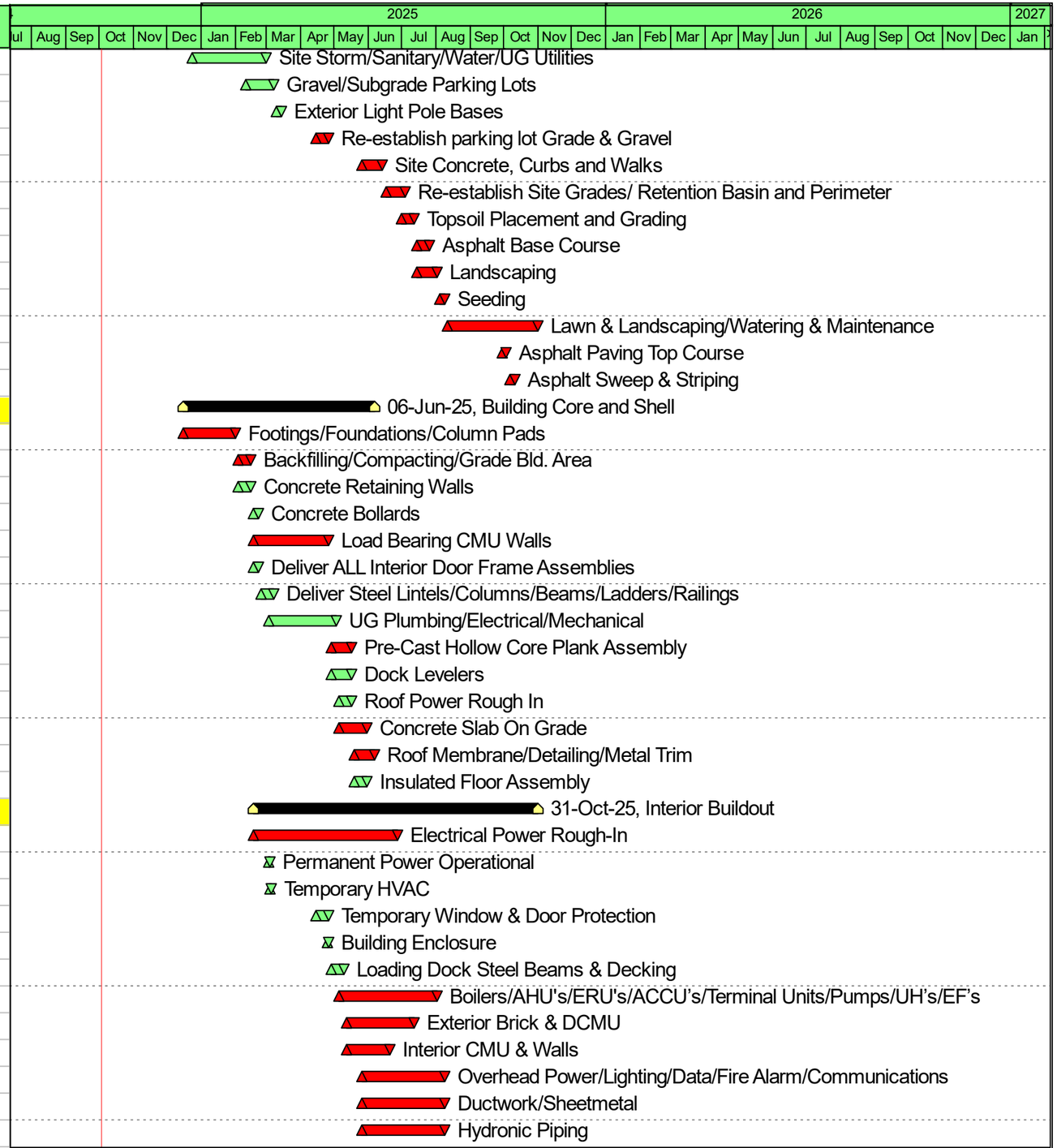

Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

**224010.07 - KPS District Kitchen**
**Guideline Schedule - 08-Oct-24**



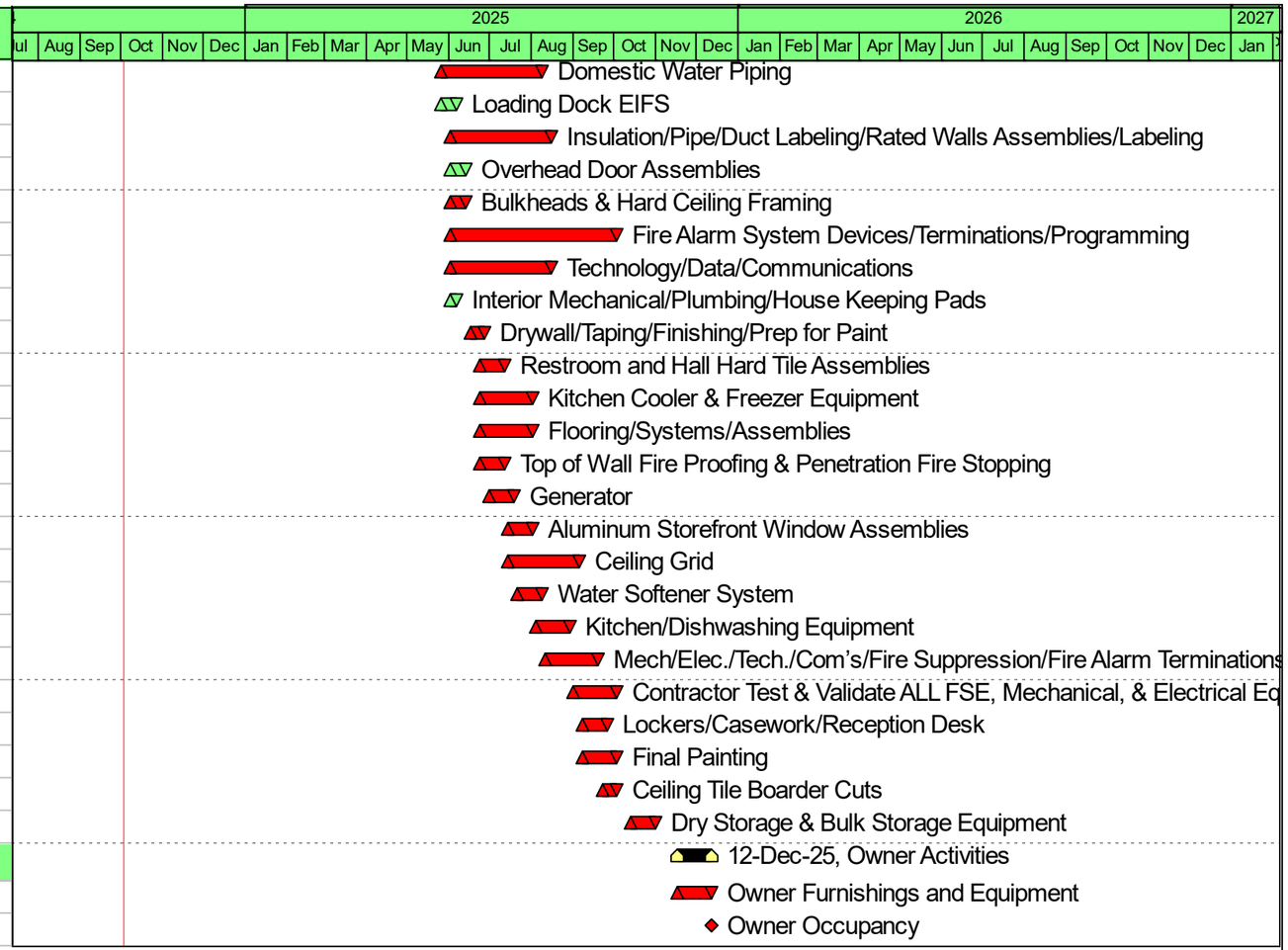
SKILLMAN

| Activity Name | Original Duration | Start | Finish |
|---|---|---|---|
| Site Storm/Sanitary/Water/UG Utilities | 50 | 23-Dec-24 | 28-Feb-25 |
| Gravel/Subgrade Parking Lots | 20 | 10-Feb-25 | 07-Mar-25 |
| Exterior Light Pole Bases | 5 | 10-Mar-25 | 14-Mar-25 |
| Re-establish parking lot Grade & Gravel | 10 | 14-Apr-25 | 25-Apr-25 |
| Site Concrete, Curbs and Walks | 15 | 26-May-25 | 13-Jun-25 |
| Re-establish Site Grades/ Retention Basin and Perimeter | 15 | 16-Jun-25 | 04-Jul-25 |
| Topsoil Placement and Grading | 10 | 30-Jun-25 | 11-Jul-25 |
| Asphalt Base Course | 10 | 14-Jul-25 | 25-Jul-25 |
| Landscaping | 15 | 14-Jul-25 | 01-Aug-25 |
| Seeding | 5 | 04-Aug-25 | 08-Aug-25 |
| Lawn & Landscaping/Watering & Maintenance | 60 | 11-Aug-25 | 31-Oct-25 |
| Asphalt Paving Top Course | 5 | 29-Sep-25 | 03-Oct-25 |
| Asphalt Sweep & Striping | 5 | 06-Oct-25 | 10-Oct-25 |
| **Building Core and Shell** | 125 | 16-Dec-24 | 06-Jun-25 |
| Footings/Foundations/Column Pads | 35 | 16-Dec-24 | 31-Jan-25 |
| Backfilling/Compacting/Grade Bld. Area | 10 | 03-Feb-25 | 14-Feb-25 |
| Concrete Retaining Walls | 10 | 03-Feb-25 | 14-Feb-25 |
| Concrete Bollards | 11-A | 17-Feb-25 | 21-Feb-25 |
| Load Bearing CMU Walls | 50 | 17-Feb-25 | 25-Apr-25 |
| Deliver ALL Interior Door Frame Assemblies | 5 | 17-Feb-25 | 21-Feb-25 |
| Deliver Steel Lintels/Columns/Beams/Ladders/Railings | 10 | 24-Feb-25 | 07-Mar-25 |
| UG Plumbing/Electrical/Mechanical | 45 | 03-Mar-25 | 02-May-25 |
| Pre-Cast Hollow Core Plank Assembly | 15 | 28-Apr-25 | 16-May-25 |
| Dock Levelers | 15 | 28-Apr-25 | 16-May-25 |
| Roof Power Rough In | 10 | 05-May-25 | 16-May-25 |
| Concrete Slab On Grade | 20 | 05-May-25 | 30-May-25 |
| Roof Membrane/Detailing/Metal Trim | 15 | 19-May-25 | 06-Jun-25 |
| Insulated Floor Assembly | 10 | 19-May-25 | 30-May-25 |
| **Interior Buildout** | 185 | 17-Feb-25 | 31-Oct-25 |
| Electrical Power Rough-In | 95 | 17-Feb-25 | 27-Jun-25 |
| Permanent Power Operational | 1 | 03-Mar-25 | 03-Mar-25 |
| Temporary HVAC | 1 | 04-Mar-25 | 04-Mar-25 |
| Temporary Window & Door Protection | 10 | 14-Apr-25 | 25-Apr-25 |
| Building Enclosure | 1 | 25-Apr-25 | 25-Apr-25 |
| Loading Dock Steel Beams & Decking | 10 | 28-Apr-25 | 09-May-25 |
| Boilers/AHU's/ERU's/ACCU's/Terminal Units/Pumps/UH's/EF's | 65 | 05-May-25 | 01-Aug-25 |
| Exterior Brick & DCMU | 45 | 12-May-25 | 11-Jul-25 |
| Interior CMU & Walls | 30 | 12-May-25 | 20-Jun-25 |
| Overhead Power/Lighting/Data/Fire Alarm/Communications | 55 | 26-May-25 | 08-Aug-25 |
| Ductwork/Sheetmetal | 55 | 26-May-25 | 08-Aug-25 |
| Hydronic Piping | 55 | 26-May-25 | 08-Aug-25 |




Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

| Activity Name | Original Duration | Start | Finish |
|---|---|---|---|
| Domestic Water Piping | 55 | 26-May-25 | 08-Aug-25 |
| Loading Dock EIFS | 10 | 26-May-25 | 06-Jun-25 |
| Insulation/Pipe/Duct Labeling/Rated Walls Assemblies/Labeling | 55 | 02-Jun-25 | 15-Aug-25 |
| Overhead Door Assemblies | 10 | 02-Jun-25 | 13-Jun-25 |
| Bulkheads & Hard Ceiling Framing | 10 | 02-Jun-25 | 13-Jun-25 |
| Fire Alarm System Devices/Terminations/Programming | 90 | 02-Jun-25 | 03-Oct-25 |
| Technology/Data/Communications | 55 | 02-Jun-25 | 15-Aug-25 |
| Interior Mechanical/Plumbing/House Keeping Pads | 5 | 02-Jun-25 | 06-Jun-25 |
| Drywall/Taping/Finishing/Prep for Paint | 10 | 16-Jun-25 | 27-Jun-25 |
| Restroom and Hall Hard Tile Assemblies | 15 | 23-Jun-25 | 11-Jul-25 |
| Kitchen Cooler & Freezer Equipment | 30 | 23-Jun-25 | 01-Aug-25 |
| Flooring/Systems/Assemblies | 30 | 23-Jun-25 | 01-Aug-25 |
| Top of Wall Fire Proofing & Penetration Fire Stopping | 15 | 23-Jun-25 | 11-Jul-25 |
| Generator | 15 | 30-Jun-25 | 18-Jul-25 |
| Aluminum Storefront Window Assemblies | 15 | 14-Jul-25 | 01-Aug-25 |
| Ceiling Grid | 40 | 14-Jul-25 | 05-Sep-25 |
| Water Softener System | 15 | 21-Jul-25 | 08-Aug-25 |
| Kitchen/Dishwashing Equipment | 20 | 04-Aug-25 | 29-Aug-25 |
| Mech/Elec./Tech./Com's/Fire Suppression/Fire Alarm Terminations i | 30 | 11-Aug-25 | 19-Sep-25 |
| Contractor Test & Validate ALL FSE, Mechanical, & Electrical Equipı | 25 | 01-Sep-25 | 03-Oct-25 |
| Lockers/Casework/Reception Desk | 15 | 08-Sep-25 | 26-Sep-25 |
| Final Painting | 20 | 08-Sep-25 | 03-Oct-25 |
| Ceiling Tile Boarder Cuts | 10 | 22-Sep-25 | 03-Oct-25 |
| Dry Storage & Bulk Storage Equipment | 15 | 13-Oct-25 | 31-Oct-25 |
| **Owner Activities** | 20 | 17-Nov-25 | 12-Dec-25 |
| Owner Furnishings and Equipment | 20 | 17-Nov-25 | 12-Dec-25 |
| Owner Occupancy | 0 | | 12-Dec-25 |




Actual Work
Remaining Work
Critical Remaining Work
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**224010.07 - KPS District Kitchen**
**Guideline Schedule - 08-Oct-24**


SKILLMAN

**KPS District Kitchen - Pre-Bid RFI Log**

Date - 10/3/2024

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| RFI # | Company Submitting RFI | Date Received | RFI Description | RFI Response |
|---|---|---|---|---|
| 1 | Earley & Associates | 9/27/2024 | As far as scope of work;<br>1) Which bid category is to provide and set trench drain in the exterior truck dock?<br>2) Which bid category provides the bollards and covers?<br>3) Which bid category installs the light pole bases?<br><br>For the drawings<br>1) detail 4 on S301 does not call out the rebar for the footing and wall, nor does it provide footing thickness<br>2) detail 3 on S301 does not call dimension the size of the footing<br>3) detail 5 and 6 on S301 does not call out rebar in the walls<br>4) the wall footing schedule on S101 does not provide the spacing for the transverse rebar | Refer to Addendum No. 1 for Scope of Work items, 1, 2 & 3. Skillman. |
| 2 | Schepers Concrete | 9/30/2024 | Do you have a schedule for this project?<br><br>What scope will be responsible for interior/exterior housekeeping pads?<br><br>Will the electrician be responsible for light pole bases?<br><br>Who will furnish the exterior trench drain in the loading dock?<br><br>I see thermal insulation is not listed under work category 03 – Concrete. Who will provide foundation and under slab insulation?<br><br>Which contractor will be responsible for the freezer slab insulation and pressure treated lumber around the exterior of the slab?<br><br>Exterior concrete spec 321313 has white cement listed. There is a significant price increase in this from traditional gray cement. This has been in a number of Tower Pinkster spec sections lately and every time I ask they tell me gray is ok to use. I think it keeps getting copied from a decorative concrete job. Could you confirm if gray cement is acceptable? | Refer to Addendum No. 1 for answers to your questions. Skillman. Grey Cement use is acceptable. Skillman. |
| 3 | Stafford-Smith, Inc | 10/1/2024 | The traulsen model numbers provided for both items reflect one door units however the plans show these units with 2 doors.<br>Can you confirm what you need. Also do you need these units remote or self-contained | |
| 4 | Skillman | 10/2/2024 | Since this wall surrounding the cooler/freezer is a fire rated CMU wall, shouldn't these openings in the CMU wall at the cooler doors be a fire rated door? I understand that they wouldn't want another typical door to open to just get to the cooler door (and a coiling fire door might be the way to go) but seems like just an opening in the CMU wall would defeat the rated CMU wall rating. | |
| 5 | Stafford-Smith, Inc | 10/2/2024 | I am looking for the Pipe SIZE for the refrigeration. I don't see it noted anywhere. Please advise. | |
| 6 | ElectroMedia | 10/2/2024 | Bid Category 15, Technology.<br>Print T401 Detail 4 calls for a fiber tray for the WAN fiber. Who is installing the WAN fiber? I don't see any specs or prints depicting fiber other than a fiber tray in the data rack. | Bid Category No. 15 Technology shall provide the WAN fiber. Skillman. |
| 7 | Bracy and Jahr, Inc. | 10/3/2024 | FERO Fast Bracket. This product is listed on the structural drawings but I do not find a spec for them.I don't find them listed in the scope of works, who will be responsible for supplying and installing? Thank you. | Refer to Addendum No. 1. Bid Category No. 4 Masonry will provide the Ferro Fast Brackets. Please keep in mind the term "provide" by definition is to furnish and install a complete assembly. |

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# ADDENDUM NO. 1

| | |
|---|---|
| **DATE OF ISSUANCE:** | **October 7, 2024** |
| **PROJECT:** | **KPS District Kitchen**<br>**6750 Chime Street**<br>**Kalamazoo, MI 49008** |
| **OWNER:** | **Kalamazoo Public Schools** |
| **ARCHITECT'S PROJECT NO.:** | **18-502.00** |
| **ORIGINAL BID ISSUE DATE:** | **September 20, 2024** |

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**SCOPE OF WORK**

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

**DOCUMENTS INCLUDED IN THIS ADDENDUM**

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

- Bidding Documents: **NA**
- Contract Conditions: **NA**
- Specification Sections: **08 0671, 08 7100, 23 0900, 28 3100**
- Drawings: **C200, C300, A101, A 602, L001, S 004, S 101, S 102, S 201, S 301, P 301, P 302, P 501, M 101, M 150, M 201, M 301, M 401, M 502, M 604, ES101, and E404**

**CHANGES TO PREVIOUSLY ISSUED ADDENDA**

None.

**CHANGES TO SPECIFICATIONS**

**ADD-1 Item No. S-1 - <Revised Spec Sections 08 0671, and 08 7100**

Refer to Specification Section: 08 0671 Door Hardware Schedule and 08 7100 Door Hardware (reissued):

Both spec sections are completely replaced.

**ADD-1 Item No. S-2 - Revised Spec Section 28-3100**

Refer to Specification Section: 26-3100 Fire Detection and Alarm (not reissued):

Added Simplex as approved manufacturer.

**ADD-1 Item No. S-3 - Revised Spec Section 23-0900**

Refer to Specification Section: 23-0900 Instrumentation and Control for HVAC (reissued):

Added basis of design for carbon monoxide and nitrogen dioxide gas detectors to 2.19 Other Control Hardware.

**CHANGES TO DRAWINGS**

**ADD-1 Item No. D-1 - Door Schedule Door Finishes**

Refer to Sheet(s): A501 (not reissued):

Aluminum doors and frames are to be clear anodized, Wood doors are to be factory finished and Hallow metal doors and frames are to be factory primed and field painted.

**ADD-1 Item No. D-2 - CMU Chases (Bulk Dry Storage)**

Refer to Sheet(s): A101 (reissued):

Provide 6" CMU chases as shown in the Bulk Dry Storage Room. Prime and paint and with bullnose cmu. Coord. With Mech. Drawings.

**ADD-1 Item No. D-3 - Natural Gas Updates**

Refer to Sheet(s): P301, P302, P501, M502 (reissued):

Updated sizing of boiler, water heater, and utility distribution system natural gas piping. Updated details, tags, and keynotes as indicated.

**ADD-1 Item No. D-4 - Plumbing Details**

Refer to Sheet(s): P302, P501 (not reissued):

Updated domestic water heater detail to show accurate venting, pipe sizing, and recirculation pump.

Updated water service detail and added tags on enlarged plan for incoming water size.

**ADD-1 Item No. D-5 - Sheet Metal Updates**

Refer to Sheet[s]: M101, M150, M301, M502 (Reissued):

Updated sizes of existing rooftop exhaust fans as indicated. Added EF-5 and IH-2.

Updated sizes of existing unit heaters as indicated. Added UH-110A,B,C and UH-111A,B,C.

Updated sizes of existing diffusers as indicated. Added SA-8 and EA-2.

**ADD-1 Item No. D-6 - Mechanical Controls**

Refer to Sheet: M604 (Newly issued):

Added Sheet M 604 - Mechanical Controls.

**ADD-1 Item No. D-7 - Hydronic Updates**

Refer to Sheet[s]: M201, M301, M401, M502 (Reissued):

Rebalanced hydronic system to accommodate additional loads from new unit heaters.

Updated system pump basis of design.

Noted locations for carbon monoxide and nitrogen dioxide gas detectors.

**ADD-1 Item No. D-8 - Added Electrical Light Fixture Equals**

Refer to Sheet[s]: ES101 and E404 (Reissued):

Added approved equals to site lighting and building lighting fixture schedules.

Added approved equals to lighting control details.

**ADD-1 Item No. D-9 - Dumpster Enclosure**

Refer to Sheet[s]: C 200 (Reissued), C 300 (Reissued), L 001 (Reissued), S 102 (Newly Issued), and A 602 (Newly issued):

- Civil: Revised drawings to reflect new dumpster enclosure, revised grading and added spot elevations.
- Landscape: Dumpster enclosure location was added to landscape plan for site context.
- Structural: added columns, foundation walls and footings for new dumpster enclosure walls.
- Architectural: added plan view, exterior elevations, and details for new dumpster enclosure.

**ADD-1 Item No. D-10 - Misc. Structural Updates**

Refer to Sheet(s): S 004, S 101, S 201, S 301 (Reissued):

Added new P2 pier detail. Added clarifying dimensions to foundation plan and details. Added missing reinforcement information to foundation plan and details. Updated and added new locations of rooftop equipment and roof openings on framing plan.

**END OF ADDENDUM.**

# SECTION 08 0671 – DOOR HARDWARE SCHEDULE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service

representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

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

1.6 MAINTENANCE SERVICE

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

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a

hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 7100 – Door Hardware.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RU - Corbin Russwin
4. BE - BEST Locks & Closers
5. HS - HES
6. RO - Rockwood
7. RF - Rixson
8. NO - Norton
9. OT - Other

## Hardware Sets

### Set: 1.0

Doors: 111E

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-SLF-HD1 | | PE |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Electric Strike | 1500C | 630 | HS ϟ |
| 1 | Strike Latch Guard | 150 | | HS |
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS ϟ |
| 1 | Surface Closer | CPS7500 | 689 | NO |
| 1 | Weatherstrip | Integral to door/frame assembly | | OT |
| 1 | Sweep | 345CNB TKSP | | PE |
| 1 | Threshold | 171A MSES25SS | | PE |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK ϟ |

| | | | | |
|---|---|---|---|---|
| 1 | Power Supply | Provided by Others | | OT ϟ |
| 1 | Card Reader | Provided by Others | | OT ϟ |
| 1 | A-Phone | Provided by Others | | OT |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader, or intercom unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

**Set: 2.0**

Doors: 110C

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-SLF-HD1 | | PE |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Electric Strike | 1500C | 630 | HS ϟ |
| 1 | Strike Latch Guard | 150 | | HS |
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS ϟ |
| 1 | Surface Closer | CPS7500 | 689 | NO |
| 1 | Weatherstrip | Integral to door/frame assembly | | OT |
| 1 | Sweep | 345CNB TKSP | | PE |
| 1 | Threshold | 171A MSES25SS | | PE |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK ϟ |
| 1 | Power Supply | Provided by Others | | OT ϟ |
| 1 | Card Reader | Provided by Others | | OT ϟ |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

**Set: 3.0**

Doors: 001A

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-SLF-HD1 | | PE |
| 1 | Nightlatch | ED5200S K157ET x LC M110 M54 M52 | 630 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Rim Cylinder | 12E-72 Less Core (with disposable constr core) | 626 | BE |
| 2 | Core | Provided by Kalamazoo Public Schools | 626 | BE |

| | | | | |
|---|---|---|---|---|
| 1 | Electric Strike | 9700 | 630 | HS |
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS |
| 1 | Pull | RM201 Mtg-Type 12XHD | US32D-316 | RO |
| 1 | Conc Overhead Stop | 6-X36 | 630 | RF |
| 1 | Surface Closer | J7500 x mounting plate, if required | 689 | NO |
| 1 | Weatherstrip | Integral to door/frame assembly | | OT |
| 1 | Sweep | 345CNB TKSP | | PE |
| 1 | Threshold | 171A MSES25SS | | PE |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK |
| 1 | Power Supply | Provided by Others | | OT |
| 1 | Card Reader | Provided by Others | | OT |
| 1 | Remote Push Button | Provided by Others | | OT |
| 1 | A-Phone | Provided by Others | | OT |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader, intercom, or remote pushbutton unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

**Set: 4.0**

Doors: 112B

| | | | | |
|---|---|---|---|---|
| 2 | Continuous Hinge | CFM-SLF-HD1 | | PE |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Mortise Exit Device | ED5600 K1M57ET x LC M54 M110 | 630 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Pull | RM201 Mtg-Type 12XHD | US32D-316 | RO |
| 1 | Surf Overhead Stop | 10-X36 | 630 | RF |
| 1 | Surface Closer | CPS7500 | 689 | NO |
| 1 | Weatherstrip | Integral to door/frame assembly | | OT |
| 2 | Sweep | 345CNB TKSP | | PE |
| 1 | Threshold | 171A MSES25SS | | PE |

**Set: 5.0**

Doors: 103A

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-SLF-HD1 | | PE |
| 1 | Exit Only | ED5200S EO M110 M54 M51 | 630 | RU |
| 1 | Surface Closer | CPS7500 | 689 | NO |
| 1 | Weatherstrip | Integral to door/frame assembly | | OT |
| 1 | Sweep | 345CNB TKSP | | PE |

| | | | | |
|---|---|---|---|---|
| 1 | Threshold | 171A MSES25SS | | PE |

**Set: 6.0**

Doors: 001C

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-HD1 | | PE |
| 1 | Nightlatch | ED5200S K157ET x LC M110 M54 M52 | 630 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Rim Cylinder | 12E-72 Less Core (with disposable constr core) | 626 | BE |
| 2 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Electric Strike | 9700 | 630 | HS |
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS |
| 1 | Pull | RM201 Mtg-Type 12XHD | US32D-316 | RO |
| 1 | Surface Closer | CPS7500 SN-134 | 689 | NO |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK |
| 1 | Power Supply | Provided by Others | | OT |
| 1 | Card Reader | Provided by Others | | OT |
| 1 | Remote Push Button | Provided by Others | | OT |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader or remote pushbutton unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

**Set: 7.0**

Doors: 001B

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-HD1 | | PE |
| 1 | Nightlatch | ED5200S K157ET x LC M110 M54 M52 | 630 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Rim Cylinder | 12E-72 Less Core (with disposable constr core) | 626 | BE |
| 2 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Electric Strike | 9700 | 630 | HS |
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS |
| 1 | Pull | RM201 Mtg-Type 12XHD | US32D-316 | RO |
| 1 | Surface Closer | PR7500 SN-134 | 689 | NO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK |
| 1 | Power Supply | Provided by Others | | OT |
| 1 | Card Reader | Provided by Others | | OT |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

**Set: 8.0**

Doors: 112

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Fire Rated Rim Exit, NL | ED5200A N957ET M110 M54 | 630 | RU |
| 1 | Rim Cylinder | 12E-72 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | PR7500 SN-134 | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 9.0**

Doors: 112A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 3 | Spring Hinge | 1502 | US26D | MK |
| 1 | Flush Bolt | 2849 (top only with fire bolt) | US26D | RO |
| 1 | Mortise Exit Device | ED5600A N9M57 x LC M54 M110 | 630 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Coordinator | 2600 Series | US28 | RO |
| 1 | Mounting Bracket | 2601AB / 2601C | US28 | RO |
| 1 | Surface Closer | CPS7500 SN | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Gasketing | S88BL | | PE |
| 1 | Astragal | S773C | | PE |

**Set: 10.0**

Doors: 101A, 101B, 106

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Classroom Lock | ML2055 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |

**Set: 11.0**

Doors: 100A, 101C, 105B

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Classroom Lock | ML2055 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |

**Set: 12.0**

Doors: 102A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Classroom Lock | ML2055 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 13.0**

Doors: 105A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Classroom Lock | ML2004 NSA V01 LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core(with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |

**Set: 14.0**

Doors: 103, 105B, 100B, 102

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Classroom Lock | ML2004 NSA V01 LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | PR7500 SN | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |

**Set: 15.0**

Doors: 113, 114

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2714 | US26D | MK |
| 1 | Privacy Lock | ML2060 NSA M34 V21 | 626 | RU |

| | | | | |
|---|---|---|---|---|
| 1 | Surface Closer | 7500 SN- pull side mount | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |
| 1 | Coat Hook | 796 | US26D | RO |

**Set: 16.0**

Doors: 111B

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | PR7500 SN | 689 | NO |
| 1 | Armor Plate | K1050 36" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 3 | Silencer | 608 / 609 | | RO |

**Set: 17.0**

Doors: 104, 108A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Armor Plate | K1050 F 36" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 17.1**

Doors: 112C

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | CPS7500 SN pull side mount | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 18.0**

Doors: 110A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |

| | | | | |
|---|---|---|---|---|
| 1 | Surface Closer | PR7500 SN | 689 | NO |
| 1 | Armor Plate | K1050 F 36" high CSK BEVUS32D | | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 19.0**

Doors: 110B

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | CPS7500 SN | 689 | NO |
| 1 | Armor Plate | K1050 F 36" high CSK BEV | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 20.0**

Doors: 107

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Classroom Lock | ML2055 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surf Overhead Stop | 10-X36 | 630 | RF |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 21.0**

Doors: 110E

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Classroom Lock | ML2055 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Surface Closer | 7500 SN pull side mount | 689 | NO |
| 1 | Armor Plate | K1050 F 36" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |

**Set: 22.0**

Doors: 111A

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3786 | US26D | MK |
| 1 | Storeroom Lock | ML2057 NSA LC | 626 | RU |
| 1 | Mortise Cylinder | 1E-74 Less Core (with disposable constr core) | 626 | BE |
| 1 | Core | Provided by Kalamazoo Public Schools | 626 | BE |
| 1 | Electric Strike | 1500C | 630 | HS |

| | | | | |
|---|---|---|---|---|
| 1 | SMART Pac Bridge Rectifier | 2005M3 | | HS |
| 1 | Surface Closer | PR7500 SN | 689 | NO |
| 1 | Kick Plate | K1050 10" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 / 409 | US32D | RO |
| 1 | Gasketing | S88BL | | PE |
| 1 | ElectroLynx Harness | QC-C1500P (electric strike to j-box) | | MK |
| 1 | Power Supply | Provided by Others | | OT |
| 1 | Card Reader | Provided by Others | | OT |

Notes:

Door normally closed and locked.
Presentation of valid credential at card reader unlocks electric strike allowing ingress.
Free egress at all times.
Fail-secure.

END OF SECTION 08 0671

# SECTION 08 7100 – DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section “Access Control Hardware”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. Michigan Building Code 2012, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

## 1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

**F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware. This meeting is mandatory.**

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required. This meeting is mandatory.

2. Coordination of Trades Meeting for openings with electromechanical hardware to be facilitated by the Construction Manager.
    a. Review sequence of operation narratives for each unique access controlled opening.
    b. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
    c. Review and finalize construction schedule and verify availability of materials.
    d. Review the required inspecting, testing, commissioning, and demonstration procedures.

**G. Post-installation Conference: After installation of door hardware, conduct a project specific training meeting to examine the installing contractors' personnel installation and adjustment of their respective products. Post-installation conference to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. This meeting is mandatory.**

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

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

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

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

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

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

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

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

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

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

    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. Hinges for 180 degree openings: Provide wide throw hinges as required to make sure door can swing 180 degrees.

5. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: 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.

6. Acceptable Manufacturers:

a. Hager Companies (HA).
b. McKinney Products (MK).
c. Ives (IV).

## 2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Acceptable Manufacturers:

a. Ives
b. Rockwood Manufacturing (RO).
c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

A. Cylinders: Existing 7-Pin small format interchangeable core (SFIC) Best key system.

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. 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.

4. Provide all cylinder housings with disposable construction core.
5. Owner (KPS) provides final cores.
6. Acceptable manufacturers:
    a. Stanley Best (BE).
    b. Marshall Best Systems (MB).

## 2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) – ML2000 Series.
    b. Sargent Manufacturing (SA) – 8200 Series.
    c. Schlage (SC) – L9000 Series.
    d. Stanley Best (BE) – 40H Series.

## 2.6 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. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
3. Dustproof Strikes: BHMA A156.16.

## 2.7 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 including installation and adjusting information on inside of cover.

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. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. 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 physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. All regular mount (pull side mount) and parallel arm mount closers shall have thru-bolt fasteners for mounting.

8. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and thru-bolt and security type fasteners as required for proper installation.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Acceptable Manufacturers:

a. Norton Door Controls (NO) – 7500 Series.
b. LCN Closers (LC) - 4040XP Series.
c. NOTE: Install all closers on Wood Doors with thru-bolts. Do not thru-bolt exterior aluminum doors.

## 2.8 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and

not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

5. Acceptable Manufacturers:

    a. Rockwood Manufacturing (RO).

## 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 certified 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.

1. Acceptable Manufacturers:

    a. Rockwood Manufacturing (RO).
    b. Trimco (TC).
    c. Ives

## 2.10 ARCHITECTURAL SEALS

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 UBC 7-2, 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. Acceptable Manufacturers:

1. National Guard Products (NG).
2. Pemko Manufacturing (PE).
3. Reese Enterprises, Inc. (RS).

## 2.11 ELECTRONIC ACCESSORIES

A. Card Readers, Power Supplies, Door Contacts and Request to Exit provided by Security Contractor.

## 2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

## 3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating 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 devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

## 3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

## 3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

## 3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

END OF SECTION 08 7100

**SECTION 23 0900 – INSTRUMENTATION AND CONTROL FOR HVAC**

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall include furnishing all labor, materials, equipment, and service necessary for a complete and operating Building Management System (BMS), utilizing direct digital controls. The BMS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet. This shall include HVAC control, electrical, gas and water metering, energy management, alarm monitoring, security and personnel access control, fire-life safety system monitoring, and all trending, reporting and maintenance management functions related to normal building operations all as indicated.
   1. New Work shall communicate with and be integrated into Owner's existing district wide DDC control system.
   2. All labor, material, equipment and software not specifically referred to herein or on the plans, required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
   3. The intent of this specification is to provide a system that is consistent with BMS systems throughout the owner's facilities running the Niagara 4 Framework.
   4. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet and MODBUS.
   5. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
   6. Any control vendor that shall provide additional BMS server software shall be unacceptable. Only systems that utilize the Niagara 4 Framework shall satisfy the requirements of this section.
   7. The BMS server shall host all graphic files for the control system. All graphics and navigation schemes for this project shall match those that are on the existing campus Niagara 4 Framework server.
   8. Graphics, banner, functionality, navigation, data points, trends, and, etc. shall match the District's Template.
   9. Owner shall receive all Administrator level login and passwords for engineering toolset prior to the final 10% of the project payment. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
   10. OPEN NIC STATEMENTS - All Niagara 4 software licenses shall have the following NiCS set to ALL: "accept.station.in=*"; "accept.station.out=*"; "accept.wb.in=*"; "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications.
   11. All JACE hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted "safe boot" technology.
   12. All JACE (SNC) and Station PASS PHRASES and PASSWORDS will be provided to the Owner or their representative at 90% completion or prior to retention being paid.
   13. To ensure quality, only JACE/WEBs 8000 hardware products will be used on this project.

B. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
2. FCC, Part 15, Subpart B, Class B
3. FCC, Part 15, Subpart C
4. FCC, Part 15, Subpart J, Class A Computing Devices.
5. UL 504 - Industrial Control Equipment.
6. UL 506 - Specialty Transformers.
7. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.
8. UL 916 - Energy Management Systems All.
9. UL 1449 - Transient Voltage Suppression.
10. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
11. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
12. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
13. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
14. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
    a. NEMA 250 - Enclosures for Electrical Equipment.
15. NEMA ICS 1 - Industrial Controls and Systems.
16. NEMA ST 1 - Specialty Transformers.
17. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.
18. CE 61326
19. C-Tick
20. cUL

C. Work shall include but not limited to providing controls and instrumentation in accordance with equipment sequence of operations and their point lists. Point lists shall be a guide to the points required for control system. Final points required shall be determined by sequence of operation requirements.

D. Work required in this section shall include the complete Building Management System (BMS) including all controllers Interoperable LonWorks Controllers (ILC), Interoperable BACnet Controllers (IBC), control devices, control panels, controller programming, controller programming software, controller input/output wiring, power wiring, interlock and safety wiring, graphical user interface, Graphical User Interface (GUI), Graphical Development Tool (GDT), Network Area Controller(s) (NAC), server software, controller software and programming of the NAC and server, development of all graphical screens, setup of schedules, logs and alarms, global server software control applications, system integration and coordination of the NAC and server software to the Wide Area Network.

E. Ethernet LAN wiring, and Ethernet routing devices if applicable. The BMS shall provide a single point Ethernet connection utilizing OBIX TCP/IP to the Owner's WAN.

F. Work required in this section shall include providing all electrical work required for this section. The system shall include all interconnecting wiring and conduit as required for a fully operational system as specified. Wiring shall be installed as per local codes or Division 26 whichever is more stringent.

1. Power supply wiring and conduit from power source to power connection on DDC controls and DDC control panels.

a. Line voltage wiring shall utilize methods and materials complying with the requirements of the Electrical Specifications, local building code, and NEC.

2. Control wiring and conduit between field-installed controls, indicating devices, and control panels.
   a. Low voltage wiring shall use methods and materials complying with the requirements of the Electrical Specifications, local building code and NEC. Plenum rated cable is acceptable where concealed and accessible.

1.2 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:

1. Division 01 Section "Alternates" for requirements of alternates that relate to this Section.

2.
   a. Alternate No. 1 pertains to training the owner on the use of building controls.

1.3 WORK BY OTHERS

A. Setting in place of control valves, flow meters, water pressure and differential taps, flow switches, thermal wells, control dampers, airflow stations, and access doors.

B. Duct smoke detectors provide under Division 28.

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1. Actuator: Control device that opens or closes valve or damper in response to control signal.
2. AI: Analog Input.
3. AO: Analog Output.
4. Analog: Continuously variable state over stated range of values.
5. BMS: Building Management System.
6. DDC: Direct Digital Control.
7. Discrete: Binary or digital state.
8. DI: Discrete Input.
9. DO: Discrete Output.
10. FC: Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
11. FO: Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
12. GUI: Graphical User Interface.
13. HVAC: Heating, Ventilating and Air Conditioning.
14. IDC: Interoperable Digital Controller.
15. ILC: Interoperable Lon Controller.
16. LAN: Local Area Network.
17. Modulating: Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
18. Motorized: Control device with actuator.

19. NAC: Network Area Controller.
20. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
21. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
22. OSS: Operating System Server, host for system graphics, alarms, trends, etc.
23. Operator: Same as actuator.
24. PC: Personal Computer.
25. Peer-to-Peer: Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
26. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
27. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
28. PICS: BACnet Product Interoperability Compliance Statement.
29. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
30. Point: Analog or discrete instrument with addressable database value.
31. WAN: Wide Area Network.

1.5 ACTION SUBMITTALS

A. Refer to Division 1 for submittal administrative requirements and procedures.

B. Submittal shall consist of:

1. System architecture showing all digital devices, computers and network configuration.
2. Equipment lists of all proposed devices and equipment including data sheets of all products. Provide a PIC statement for each BACnet device and interoperability certification for each LonMark field device provided.
3. Valve, damper, and well and tap schedules showing size, configuration, capacity and location of all equipment.
4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480 character alarm message. All text shall be approved prior to data entry.
5. Schematic device wiring and piping interconnection diagrams including panel and device power and sources.
6. Software design data including flowchart of a typical DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
7. A complete written Sequence of Operation in suppliers own terminology.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data for control systems equipment to include in the operation and maintenance manual specified in Division 1. Include the following:

1. Maintenance instructions and spare parts lists for each type of control device.
2. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
3. Calibration records and list of set points.

B. Project Record Documents: Upon completion of the work, provide a complete set of 'as-built' drawings and application software on USB drive media or compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Three copies of the 'as-built' drawings shall be provided in addition to the documents on USB drive media or compact disk.

1.7 CODES AND APPROVALS

A. The complete BMS installation shall be in strict compliance to the national, state and local mechanical and electrical codes and the electrical section of these specifications. All devices shall be UL or FM listed and labeled for the specific use, application and environment to which they are applied.

B. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air conditioning.

C. System shall be designed and manufactured to ISO 9001 quality standard, and all electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

1.8 WARRANTY

A. All components, system software, and parts supplied by the BMS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BMS contractor at no charge shall furnish labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the Owners request for warranty service within 48 hours during normal business hours.

B. Warranty Access

1. The Owner shall grant to the controls installer reasonable access to the BMS during the warranty period.

1.9 BMS CONTRACTOR QUALIFICATIONS

A. The BMS contractor shall have a local office within a 75 mile(120 Km) radius of the job site, staffed with and NiagaraN4 Certified factory trained engineers fully capable of providing instruction, routine maintenance and 24-hour emergency service on all system components. The BMS contractor shall have a three year experience record in the design and installation of computerized building systems similar in scope and performance to that specified herein, and shall be prepared to provide evidence of this history as condition of acceptance and approval during Submittal.

1. This office will employ at least four NiagaraN4 programmers.
2. This office will be established as a Honeywell Authorized Controls Integrator - ACI

B. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years.

C. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

## 1.10 SOFTWARE LICENSE AGREEMENT

A. Software licensing for the Network Area Controller (NAC) and server software shall give the Owner the capability to control their system and determine which contractors can bid and engineer their system.

B. It shall be possible to insure the Owner can prevent unauthorized partners from accessing the system for engineering changes.

C. Software licensing shall have the freedom to individually manage authorized parties and independent parties.

D. The Owner shall accept the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

## 1.11 ADDED POINT AND MEMORY CAPACITY

A. The BMS software/firmware provided shall have the capacity for an unlimited number of NACs. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.

B. Total system point capacity shall have the capacity for an unlimited number of future points. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.

C. Supervising software shall allow unlimited expansion. Supervising software that is limited to the number of network area controllers is not acceptable

## 1.12 BMS TESTING AND ADJUSTING

A. Control Contractor shall be responsible for adjusting and readjusting the control systems as required to obtain the desired control sequencing and intent of the specifications. Refer to Section 23 0593 and requirement that system balance be accomplished twice.

B. If proper sequencing or system functions cannot be achieved with the factory provided controls, as specified and installed by the equipment manufacturer, and additional controls are required, the required additional controls shall be added at the expense of the factory controls provider.

1.13 DELIVERY, STORAGE, AND PROTECTION

A. Store equipment and materials inside and protected from weather.

1.14 COORDINATION

A. Coordinate location of exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

D. Pre-Installation Conference: Attend a temperature controls conference with the project engineer to develop a mutual understanding of the sequencing, components, and details required for the project.

1. Engineer may invite other controls related stakeholders to this conference.
2. Provide a minimum of 7 days' advance notice of scheduled meeting time and location.

1.15 PROJECT COMMISSIONING

A. Project has an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.

PART 2 - PRODUCTS

2.1 INSTALLERS

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

1. ControlNet LLC.
2. Havel Brothers.

2.2 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, Network Area Controllers, server software server, graphical user interface software, Web Browser Clients, portable operator terminals, printers, network devices and other devices as specified herein.

B. Provide the capability to open all control valves in each individual system at one time (I.E. zone, riser) to facilitate water balancing.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate SNMP, LonWorks, BACnet IP, BACnet MSTP, Modbus TCP/IP or Modbus RTU communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet. For each Modbus device supplier must provide a Registry of data points available on the system.

C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS. Secure Socket Layer (SSL) encryption shall be an available option for remote access.

F. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.

G. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.

H. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 SYSTEM NETWORK CONTROLLER (SNC)

A. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.

B. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.

C. The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.

D. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 Fox, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

E. The SNC shall employ a device count capacity license model that supports expansion capabilities.

F. The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:

1. BACnet
2. Lon
3. MODBUS
4. SNMP
5. KNX

G. The SNC shall be capable of executing application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration of LonWorks, BACnet, and MODBUS controller data.
7. Network management functions for all SNC, PEC and ASC based devices.

H. The SNC shall provide the following hardware features as a minimum:

1. Two 10/100 Mbps Ethernet ports.
2. Two Isolated RS-485 ports with biasing switches.
3. 1 GB RAM
4. 4 GB Flash Total Storage / 2 GB User Storage
5. Wi-Fi (Client or WAP)
6. USB Flash Drive
7. High Speed Field Bus Expansion
8. -20-60°C Ambient Operating Temperature
9. Integrated 24 VAC/DC Global Power Supply

10. MicroSD Memory Card Employing Encrypted Safe Boot Technology

I. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

J. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

K. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.

1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
   a. Alarm.
   b. Return to normal.
   c. To default.

2. Alarms shall be annunciated in any of the following manners as defined by the user:
   a. Screen message text.
   b. Email of complete alarm message to multiple recipients.
   c. Pagers via paging services that initiate a page on receipt of email message.
   d. Graphics with flashing alarm object(s).

3. The following shall be recorded by the SNC for each alarm (at a minimum):
   a. Time and date.
   b. Equipment (air handler #, access way, etc.).
   c. Acknowledge time, date, and user who issued acknowledgement.

L. Programming software and all controller "Setup Wizards" shall be embedded into the SNC.

1. The SNC shall support the following security functions.
2. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
3. Role-Based Access Control (RBAC) for managing user roles and permissions.
4. Require users to use strong credentials.
5. Data in Motion and Sensitive Data at Rest be encrypted.
6. LDAP and Kerberos integration of access management.

M. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:

1. Metadata: Descriptive tags to define the structure of properties.
2. Tagging: Process to apply metadata to components
3. Tag Dictionary

N. The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD…) shall have an associated template file for reuse on future project additions.

O. The SNC shall be provided with a 5 Year Software Maintenance license. Labor to implement is to be included.

P. In order to ensure future serviceability it is the intent of this specification that the local control contractor provide all programmable microprocessor based controls for all HVAC equipment with the exception of controls that are internal to the operation of equipment, i.e. Chiller control and Boiler combustion control. It is acceptable if the equipment supplier has a DDC ready package available to include dampers, valves, actuators, sensors, relays and safeties, transformer etc. Any equipment provided devices from the factory must match those specified herein and be coordinated with the control contractor to ensure power and signal compatibility are met.

## 2.5 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

A. HVAC control shall be accomplished using LonMark or BACnet based devices where the application has a LonMark profile or BTL Listed PICS defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier shall provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. All PECs shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

C. The following integral and remote Inputs/Outputs shall be supported per each PEC:

1. Eight integral dry contact digital inputs.
2. Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
3. Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
4. Six integral 4-20 ma and/or 0-10 vdc analog outputs.
5. Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
6. One integral 20 Vdc, 65-mA power supply for auxiliary devices.
7. If a 20 Vdc 65-mA power supply terminal is not integral to the PEC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices.

D. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules.

E. PEC Controllers shall support at minimum the following control techniques:

1. General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
2. General-purpose, non-linear control loops.
3. Start/stop Loops.
4. If/Then/Else logic loops.
5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).

2.6 ADVANCED UNITARY CONTROLLER (AUC)

A. The advanced unitary controller (AUC) platform shall be designed specifically to control HVAC - ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units and radiant panels. The control shall use LonMark or BACnet based devices where the application has a LonMark profile or BTL Listed PICS defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier shall provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:

1. The controller shall be fully programmable with full functionality on any Niagara 4 brand platform.
   a. Support downloads to the controller from any brand of Niagara 4 platform.
   b. Support uploads from the controller to any brand of Niagara 4 platform.
   c. Support simulation/debug mode of the controller.
   d. Maintain native GUI.

2. The controller shall be capable of either integrating with other devices or stand-alone operation.
3. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
   a. FLASH Memory Capacity: 116 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 8 Kilobytes.

4. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77 degrees F (25 degrees C).
   c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).

5. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
6. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.

7. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.

8. The minimum controller Environmental ratings.
   a. Operating Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).
   b. Storage Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).
   c. Relative Humidity: 5% to 95% non-condensing.

9. The controller shall have the additional approval requirements, listings, and approvals:
   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
   b. CSA (LR95329-3) Listed.
   c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
   d. Meets Canadian standard C108.8 (radiated emissions).
   e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
   f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).

10. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
11. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.
    d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

12. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
13. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined on the Drawings.

## 2.7 ADVANCED VARIABLE AIR VOLUME CONTROLLER (AVAV)

A. The advanced VAV controller platform shall be designed specifically for room-level VAV control - pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO2, occupancy, and emergency control. Equipment includes: VAV terminal unit, VAV terminal unit with reheat, Series fan powered terminal unit, Parallel fan powered terminal unit, Supply and Exhaust air volume terminals and Constant volume dual-duct terminal unit. Control shall be accomplished using LonMark or BACnet based devices where the application has a LonMark profile or BTL Listed PICS defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier shall provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:

1. The controller shall be fully programmable with full functionality on any Niagara 4 brand platform.
   a. Support downloads to the controller from any brand of Niagara 4 platform.
   b. Support uploads from the controller to any brand of Niagara 4 platform.
   c. Support simulation/debug mode of the controller.
   d. Maintain native GUI.

2. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
3. The controller shall have an internal velocity pressure sensor.
   a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
   b. Operating Range: 0 to 1.5 inch H2O (0 to 374 Pa).
   c. Accuracy: ±2% of full scale at 32 degrees to 122 degrees F (0 degrees to 50 degrees C); ±1% of full scale at null pressure.

4. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications.
   a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 2 Kilobytes.

5. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77 degrees F (25 degrees C).
   c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).

6. The controller shall have Significant Event Notification, Periodic Update capability and Failure Detect when network inputs fail to be detected within their configurable time frame.
7. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.

8. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.

9. The minimum controller Environmental ratings:
   a. Operating Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
   b. Storage Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
   c. Relative Humidity: 5% to 95% non-condensing.

10. The controller shall have the additional approval requirements, listings, and approvals:

a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
b. CSA (LR95329-3) Listed.
c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
d. Meets Canadian standard C108.8 (radiated emissions).
e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).

11. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
12. The controller shall provide an integrated actuator option.
    a. Actuator type: Series Floating.
    b. Rotation stroke: 95 degrees ±3 degrees for CW or CCW opening dampers.
    c. Torque rating: 44 lb-inch (5 Nm).
    d. Run time for 90 degrees rotation: 90 seconds at 60 Hz.

13. The controller shall have digital inputs (DI), digital Triac outputs (DO), three analog outputs (AO), and universal inputs (UI).
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.

14. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The controller shall have a loop execution response time of 1 second.
16. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined on the Drawings.
    a. VAV terminal unit.
    b. VAV terminal unit fan speed control.
    c. Series fan.
    d. Parallel fan.
    e. Regulated air volume (room pressurization/de-pressurization).
    f. CV dual-duct.
    g. Room CO2 control.
    h. Room Humidity.
    i. TOD occupancy sensor stand-by set points.

## 2.8 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting TCP/IP, BACnet IP, Modbus, Java, XML, and HTTP for maximum flexibility for integration of building data with enterprise information systems

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 10 Base-T, UTP-8 wire, category 5E or 6

3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.9 NETWORK ACCESS

A. Owners WAN / LAN Access: Controls Installer must adhere to Owner's policy and requirements to obtain Owner's WAN access.

2.10 BAS SERVER & WEB BROWSER GUI - SYSTEM OVERVIEW

A. The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.

B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Window operating systems.

C. The BAS server software shall support at least the following server platforms (Windows 7, 8.1, 10, Server 12). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.

D. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:

1. Trending.
2. Scheduling.
3. Electrical demand limiting.
4. Duty Cycling.
5. Downloading Memory to field devices.
6. Real time 'live' Graphic Programs.
7. Tree Navigation.
8. Parameter change of properties.
9. Set point adjustments.
10. Alarm / event information.
11. Configuration of operators.
12. Execution of global commands.
13. Add, delete, and modify graphics and displayed data.

E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project. BAS software components shall include:

1. Server Software, Database and Web Browser Graphical User Interface.
2. 5 Year Software Maintenance license. Labor to implement is to be included.
3. Embedded System Configuration Utilities for future modifications to the system and controllers.
4. Embedded Graphical Programming Tools.
5. Embedded Direct Digital Control software.

F. BAS Server Database: The BAS server software shall utilize a Java Database Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.

G. Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:

H. Web Browser's for PC's: Only the current released browser (Explorer/Firefox/Chrome) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.

I. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol Secure (HTTPS).

## 2.11 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

B. Mobile Web Browser Navigation through Smart Phones and Tablets: In order to assure comprehensive mobile navigation with all major browsers, navigation shall be done through the use of a touch-friendly dynamic navigation bar. Right-click commands are not compatible with most mobile/touch devices, so all equipment commands shall utilize touch-compatible buttons. The contents of the dynamic navigation bar shall be customized to match the specific requirements of each building, while retaining the same general categories for consistency and ease of use.

C. Critical Data Display: The dynamic navigation bar may also display a critical data summary

D. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.

E. Navigation:

1. The buttons of the dynamic navigation bar shall be adaptive, changing hyperlink connections relevant to each system type, allowing hyperlinks, specific to the selected system to be added as requested by the consulting engineer.
2. The dynamic navigation bar at the top of each BMS page will be provided and have the following links/functions:
3. Home: A link that takes the user to a main entry point of navigation at a building or district level.
4. Main Systems Icons/Buttons: Links to general systems like HVAC, Lights, and Card Access are indicated by icon buttons. Links to major systems and equipment such Hydronic Systems or Air Handlers are listed in descriptive buttons.

5. Floor Plans: Links to floor plan sections are shown as graphic outline keys with descriptive buttons. Visual indicators highlight the part of the building that is relevant to the user's navigation (i.e. the section in which the currently viewed VAV box resides). Equipment occupancy status, when applicable, shall be indicated on the floor plan by a color-coded avatar.
6. Alarm Console: A table that shows all points that are in an alarm state and allowing users to silence or acknowledge alarms from the alarm console. The dynamic navigation bar will show the total number of unacknowledged alarms without having to go to the Alarm Console page.
7. Schedules: An at-a-glance schedule page that shows equipment schedule periods. The at-a-glance page allows users to change occupancy times with a weekly or calendar scheduler with a single click.
8. Information: A page with links to pertinent documents, including a BMS User's Guide. This page will provide legends/keys that define status colors and icons. This page will also serve as the landing page for links to the following feature pages, if they are not directly linkable from the dynamic navigation bar:
    a. Weather: A page that shows current local weather conditions in a seven-day forecast.
    b. Alarm History: A log of previous alarms that features sorting and time range filters.
    c. Audit Log: A log of users who have accessed the BMS. It records changes made by users and features sorting and time range filters.
    d. Chart Builder: A tool that allows charts to be made comparing historical data. It allows custom-built chart data to be exported as an Excel or .PDF file.
    e. Override Summary: A table of all equipment with a manual override status.
    f. User Configuration: A page that allows users to change log-in and profile information. Users with administrative rights may add or delete users to the BMS.
    g. Custom Dashboard: A page with customizable charts and gauges which can be saved independently for each operator.
    h. Email Configuration: A page that will allow administrators to set up email notification specifics for operators regarding alarms.
    i. User Configuration: A page that will allow administrators to add, delete, and edit the properties of users for the BAS.
9. Log-Out: Pressing this button will log the current user out of the BMS and return the browser to the log-in screen.
10. Navigational Info Fields: This feature provides information to the user by displaying the building name, current page name, current page description, outside air temperature, current date, and current time. The current page description is editable by the user from the graphic.

F. Graphics Pane: The Graphics Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:

1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.
2. Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards. See Section 2.13 below.
3. Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the dynamic navigation bar).
4. Alarms: Shall be used to view alarm information geographically (using the dynamic navigation bar), acknowledge alarms, sort alarms by category, actions and verify reporting actions.

5. Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.
6. Global Set Points page: This page is used to monitor and set global commands that affect multiple systems/equipment. (For example, all finned tube valves in the building would have a global minimum valve position set point and corresponding outside air temperature set point).
7. Preventative Maintenance Schedules page: This page is used to set and track runtimes for mechanical equipment. Alerts shall be sent to the Alarm Console when the runtime reaches the allocated time to notify operators that preventative maintenance is required. These runtime limits should be operator adjustable.
8. Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.

G. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:

1. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
2. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. The room temperature label colors shall be updated dynamically as a zone's actual comfort condition changes to give an at-a-glance realization of temperatures to the operator.
3. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
4. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
    a. Each piece of equipment monitored or controlled including each terminal unit.
    b. Each building.
    c. Each floor and zone controlled.

H. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ' Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ' Independence Day' Holiday. All schedules that affect the system/area/equipment shall be indicated on the Schedules Page.

1. Schedules: Schedules shall comply with the LonWorks and BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
    a. Types of schedule shall be Normal, Holiday or Override.
    b. A specific date.

c. A range of dates.
d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
e. Wildcard (example, allow combinations like second Tuesday of every month).

2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ' individual tenant' group - who may occupy different areas within a building or buildings. Schedules applied to the ' tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the ' tenant group'.
4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

I. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:

1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.

6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A ' network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BAS Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
    a. Print: Alarm information shall be printed to the BAS server's PC or a networked printer.
    b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
    c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
    d. Write Property: The write property reporting action updates a property value in a hardware module.
    e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
    f. Run External Program: The Run External Program reporting action launches specified program in response to an event.

J. Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.

1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and ' pan through' historical data by simply scrolling the mouse.
6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.

K. Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Strong Password. Access to different areas of the BAS system shall be defined in terms of Role-Based Access Control privileges as specified:

1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of ' easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
   a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
   b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
   c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.

2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

## 2.12 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

C. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:

1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.

2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software shall support a ' live' mode, where all input/output data, calculated data and set points shall be displayed in a ' live' real-time mode.

## 2.13 LONWORKS NETWORK MANAGEMENT

A. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

B. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices and to view health and status counters within devices.

C. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

D. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times and within the control system shall not be accepted.

## 2.14 CUSTOM GRAPHICS - REQUIRED

A. Home Page

1. The building site overview shall provide a “mouse over” function to highlight the floor plan area to be accessed as a navigational aid. Room numbers and/or names will be included at the owner’s request. Critical data points, i.e. Outdoor Air Temperature, Outdoor Air Relative Humidity, Hot Water Supply Temperature, Chilled Water Supply Temperature or National Weather Service data

will be continuously visible, in real time, within the HTML frame on all screens. Additional points may be added or deleted at the owner's request without cost.

B. Floor Plans

1. Detailed floor plans shall be created with a vector drawing program accurately depicting the actual building layout to include all rooms, walls, and hallways. All space sensors shall be accurately placed in their actual locations and tagged with their real time space temperature and equipment each is associated with, i.e. 72.5°F/RTU-1, 74.2°/AHU-1, 73.4°/TU-1. Floor plans too large to be practically shown with data points will provide a "mouse over" function to highlight the floor plan area to be accessed. Room numbers and/or names will be included at the owner's request.

C. Mechanical Systems

1. Detailed graphics for each mechanical system will include; AHUs, RTUs, CW Piping and Pumps, HW Piping and Pumps, TUs, and EFs as a minimum. Mechanical systems will include on-screen access to their respective set-points, trend logs and schedule. All time schedules will be setup as directed by the owner prior to final job turnover.
2. Detailed graphics for each mechanical system will include; AHUs, RTUs, HXs, CW Piping and Pumps, HW Piping and Pumps, HPs, TUs, and EFs as a minimum. Mechanical systems will include on-screen access to their respective set-points, trend logs and schedule. All time schedules will be setup as directed by the owner prior to final job turnover.
3. Dynamic trends of <u>all</u> data points shall be set up (specification will be followed as to actual number of trend points possible) prior to final job turnover. Each trend will be available directly on screen for quick trend access.
4. Data points will be shown for all relevant inputs and outputs and be positioned near the actual device. Analog and digital parameters will be able to be modified directly from the equipment screen.

D. Terminal Units

1. Terminal units such as cabinet heaters, unit heaters, VAV boxes will depict the actual configuration of the equipment controlled. Actual equipment configurations from manufacturers web sites and/or photos of installed equipment shall be used to ensure graphic depictions are as "near actual" as possible.
2. Terminal units such as heat pumps, fan coil units, unit ventilators, reheat coils, booster coils and VAV boxes will depict the actual configuration of the equipment controlled. Actual equipment configurations from manufacturers web sites and/or photos of installed equipment shall be used to ensure graphic depictions are as "near actual" as possible.

## 2.15 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser . Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMS, shall not be acceptable.

C. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
3. Storage of the graphical screens shall be in the NAC or server software, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
4. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
5. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
        1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    c. View logs and charts
    d. View and acknowledge alarms
    e. Setup and execute SQL queries on log and archive information
6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

## 2.16 SERVER SOFTWARE FUNCTIONS AND HARDWARE

A. The server software shall be provided. The server software shall support all TCP/IP connected to the control system router.

B. The Network server software shall provide the following functions, at a minimum:

1. Global Data Access: The server software shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server software shall provide the ability to execute global control strategies based on control and data objects in any control system in the network, local or remote.
3. The server software shall include a master clock service for its subsystems and provide time synchronization for all control systems.
4. The server software shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

5. The server software shall provide scheduling for all control systems and their underlying field control devices.
6. The server software shall provide demand limiting that operates across all control systems. The server software must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
7. The server software shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to control systems. Systems not employing this prioritization shall not be accepted.
8. Each control system supported by the server software shall have the ability to archive its log data, alarm data and database to the Network server software, automatically. Archiving options shall be user-defined including archive time and archive frequency.
9. The server software shall provide central alarm management for all control systems supported by the server software. Alarm management shall include:
    a. Routing of alarms to display, printer, email and pagers
    b. View and acknowledge alarms
    c. Query alarm logs based on user-defined parameters

10. The server software shall provide central management of log data for all control systems supported by the server software. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
    a. Viewing and printing log data
    b. Exporting log data to other software applications
    c. Query log data based on user-defined parameters

C. Server software Hardware Requirements: supplied by

1. The system integrator will be responsible for loading and testing the software on the PC.
2. The system integrator will coordinate with the owner for testing and authorization.

## 2.17 OBJECT LIBRARIES

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10

on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the

highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an “On” state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller or server software. At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer.

Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

3. For BACnet devices, provide the following objects at a minimum:
   a. BACnet AI
   b. BACnet AO
   c. BACnet BI
   d. BACnet BO
   e. BACnet Device

4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

## 2.18 DDE DEVICE INTEGRATION

1. The Network Area Controller shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Network Area Controller shall act as a DDE client to another software application that functions as a DDE server.
2. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the BMS. Objects provided shall include at a minimum:
   a. DDE Generic AI Object
   b. DDE Generic AO Object
   c. DDE Generic BO Object
   d. DDE Generic BI Object

## 2.19 OTHER CONTROL SYSTEM HARDWARE

A. Ethernet Switches

1. 8 Port 10/100 MBPS Switch / Hub
2. Din Rail Mounted
3. LED communication indicators
4. Acceptable Manufacturers
   a. Contemporary Controls
   b. INTEL
   c. Cisco Systems

B. Temperature Sensors and Transmitters

1. General Sensor & Transmitter Requirements
   a. Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.
   b. Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
   c. Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and provide a true linear output signal.

d. Temperature sensors shall be of the resistance type and shall be 10K or 20K Ohm Thermistor type.
   1) Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the controllers operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 50 ohm/°C. resistance change versus temperature to insure good resolution and accuracy. Thermistors shall be certified to be stable ±0.13(C. over 5 years and ±0.2(C. accurate and free from drift for 5 years.

e. The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.
   1)

| Point Type | Accuracy |
|---|---|
| Outside Air | +/-3% |
| Chilled/Hot Water | +/-1% |
| Room Temperature | +/-1% |
| Duct Temperature | +/-3% |

   2) Sensors Used in Energy Water (BTU) or Process Calculations +/-1%
   3) Sensors used in energy or process calculations shall be accurate over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Bureau of Standards (NBS) Calibration Report Nos. 209527/222173.

2. Thermowells
   a. When thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and Greenfield fitting, except where wells are to be installed under separate contract.
   b. Thermowells shall be pressure rated and constructed in accordance with the system working pressure
   c. Thermowells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
   d. Thermowells shall be constructed of the following materials:
      1) Hot Water; brass.
      2) Chilled Water; brass.
      3) Steam; 316 stainless steel.
3. Outside Air Sensors
   a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.
   c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
   d. Solar load sensors shall be provided in locations shown. The use of a thermistor combined with a solar compensator is acceptable. Provide calibration charts as part of the O&M Manual.

4. Duct Type Sensors
   a. Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.

b. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.
c. For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.

5. Averaging Duct Type Sensors
   a. Where called out on the drawings and points lists, provide averaging type duct sensors. Thermistor sensors are acceptable. The sensor shall be multi-point sensitive through the length of the temperature conducting tubing. The thermistors shall be configured in a series / parallel method which creates an end result of total average resistance equal to the same span as a standard thermistor.
   b. Provide capillary supports at the sides of the duct to support the sensing element.

6. Acceptable Manufacturers
   a. Honeywell
   b. Johnson Controls
   c. ACI
   d. Bapi

C. Relative Humidity Sensors/Transmitters

1. The sensor shall be a solid state, resistance type relative humidity sensor of the Bulk Polymer Design. The sensor element shall be washable and shall resist surface contaminations.
2. Humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2 wire isolated loop powered, 4-20ma, 0-10.0 VDC linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion.
   a. Room Type Sensor ±2% RH
   b. Duct Type Sensor ±2% RH

4. Outside air relative humidity sensors shall be installed in a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
5. Provide a single point humidity calibrator, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel and be equipped with a neoprene grommet, bushings and a mounting bracket.
7. Acceptable Manufacturers:
   a. Vailsala
   b. ACI
   c. Veris
   d. Honeywell
   e. Johnson Controls

D. Differential Pressure Transmitters and Accessories

1. General Air and Water Pressure Transmitter Requirements:
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.

b. Pressure transmitters shall provide the option to transmit a 0 to 5V dc, 0 to 10V dc, or 4 to 20 mA output signal.
c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (3 valve manifolds).
d. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.
e. Low air pressure, differential pressure transmitters used for room pressurization control (i.e. laboratories, OR's clean rooms, etc.) shall be equipped with a LED display indicating the transmitter output signal.
f. Duct sensing pressure applications where the velocity exceeds 1500 fpm shall utilize a static pressure traverse probes.

2. Low Air Pressure Applications (0 to 125 Pa)
   a. The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.
      1) Span: Not greater than two times the design space DP.
      2) Accuracy: Plus or minus 0.5% of F.S.
      3) Dead Band: Less than 0.3% of output.
      4) Repeatability: Within 0.2% of output.
      5) Linearity: Plus or minus 0.2% of span.
      6) Response: Less than one second for full span input.
      7) Temperature Stability: Less than 0.05% output shift per degree change.
   b. The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.
   c. Acceptable Manufacturers
      1) Auto Tran
      2) Veris
      3) Setra
3. Medium to High Air Pressure Applications (125 Pa to 2500 Pa)
   a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter except the performance specifications are not as severe. Provide differential pressure transmitters which meet the following performance requirements.
      1) Zero & span: (% F.S./Deg. C): .05% including linearity, hysteresis and repeatability
      2) Accuracy: 1% F.S. (best straight line)
      3) Static Pressure Effect: 0.5% F.S.
      4) Static Pressure Effect: 0.5% F.S. (to 700 KPa)
      5) Thermal Effects: <±.05% F.S. /Deg. C.
      6) Thermal Effects: <±.05% F.S. /Deg. C. over 5C. to 40C. (calibrated at 22°C.)
   b. Acceptable manufacturers:
      1) Auto Tran
      2) Veris
      3) Setra

E. Low Differential, Water Pressure Applications (0 KPa to 5 KPa)

1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20mA output in response to variation of flow meter differential pressure or water pressure sensing points.
2. The differential pressure transmitter shall have non-interactive zero and span adjustments adjustable from the outside cover and meet the following performance specifications.
   a. 0 – 10 KPa input differential pressure range

b. 4 - 20 mA output
c. Maintain accuracy up to 20 to 1 ratio turndown
d. Reference Accuracy: ± 0.2% of full span

3. Provide a two year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the Owner during the warranty period. Acceptable Manufacturers:
a. Tobar
b. Veris
c. Foxboro
d. Omega
e. Bailey
f. Modus

F. Medium to High Differential Water Pressure Applications (5 KPa to 700 KPa)

1. The differential pressure transmitter shall meet the low pressure transmitter specifications except the following:
a. Differential pressure range 5 KPa to 700 KPa.
b. Reference Accuracy: ±l% of full span (includes non-linearity, hysteresis, and repeatability)
c. Warranty: 1 year.

2. Acceptable Manufacturers:
a. Auto Tran
b. Veris
c. ACI
d. Setra

3. Bypass Valve Assembly: Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided

G. Electronic Valve And Damper Actuators

1. General Requirements
a. Electronic actuators shall be electric, direct-coupled type capable of being mounted over the shaft of the damper. They shall be UL listed and the manufacturer shall provide a 2 year unconditional warranty from the date of commissioning. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts or 4 VA for VAV actuators. Sound level shall not exceed 45 dB for high torque or 35 dB for VAV actuators.
b. Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burn-out. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.
c. Warranty must be two years by manufacturer on actuator as a whole and all components.
d. Acceptable manufacturers:
1) Honeywell
2) Johnson Controls
3) Belimo

2. Control Damper Actuators
   a. OA (outside air), RA (return air), and EA (exhaust air) actuators shall be spring return type for safety functions. Individual battery backup, capacitor return is not acceptable.
   b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within ± 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating damper position. Accuracy shall be within ± 2.5%.
   c. Face and bypass dampers and other control dampers shall be modulating using the same control circuit detailed above but shall not be spring return.

3. Miscellaneous Damper Actuators
   a. OA combustion and ventilation air intake and EA damper actuators shall be 2 position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used.
   b. OA combustion and ventilation air intake and EA damper actuators shall be 2 position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used. The minimum torque for any actuator shall be 5 N-m.
   c. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air.
   d. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air and greater than 6 KPa TSP.

4. Air Terminals
   a. Air terminal actuators shall use fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controllers' requirements.
   b. Air terminal actuators shall be minimum 5 N-m torque and use fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controllers' requirements.

5. Inlet Vanes Actuators
   a. Inlet vane actuators shall provide at least 150% of the minimum torque specified by the manufacturer as necessary to operate vanes properly. Either direct coupled or gear train with linkages are acceptable as required. The control loop for static control of the actuator shall operate slowly enough to avoid hunting and maintain stable control. See automation system specifications for details.

6. Combination Smoke and Fire Damper Actuators
   a. Actuators shall be factory mounted and connected to the damper section and shall conform to UL 555S specifications.

H. Valve Actuators

1. Control Valves Actuators (3 inch and smaller)
   a. Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's

operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.

b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.

c. Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.

2. Control Valve Actuators (4 inch and larger).

a. The valve actuator shall consist of a permanent split capacitor, reversible type electric motor which drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 8 meters, showing output shaft and valve position. Unit shall be mounting directly to the valves without brackets and adapters, or readily adapted to suit all other types quarter-turn valves.

b. The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.

c. The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.

d. The actuator shall have a self-locking gear train which is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with 70 N-m or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shaft shall run in ball bearings at each end of motor.

e. The actuator housing shall be hard anodized aluminum for full environmental protection.

f. The environmental temperature range of the actuator shall be -22 to 140 deg F(-30 t0+60 deg C).

g. For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 104 deg F(40 deg C).

h. The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in each direction of 90° rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.

i. Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cut-out protector shall be embedded in the motor windings to limit heat rise to 175 deg F(80 deg C) in a 104 deg F(40 deg C) ambient. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

j. Materials of Construction: The electric actuator shall have a pressure die-cast, hard anodized aluminum base and cover. The compound gear shall be made of die-cast, hard

anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.

k. Accessories:
   1) Potentiometer for providing continuous feedback of actuator position at the controller (for valves specified position feedback).

l. Acceptable manufacturers:
   1) Honeywell
   2) Johnson Controls
   3) Belimo

I. Control Valves

1. Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5 psig(34 kPa) at rated flow (except as may be noted on the drawings). Valves with sizes up to and including NPS 2 (DN 50) shall be "screwed" configuration and NPS 2-1/2 (DN 65) inch and larger valves shall be "flanged" configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.
2. Acceptable manufacturers:
   a. Honeywell
   b. Belimo

J. Switches

1. Differential Pressure Switches
   a. All pressure sensing elements shall be corrosion resistant. Pressure sensing elements shall be bourdon tubes, bellows, or diaphragm type. Units shall have tamper-proof adjustable range and differential pressure settings.
   b. Pressure sensor switch contacts shall be snap action micro-switch type. Sensor assembly shall operate automatically and reset automatically when conditions return to normal. Complete sensor assembly shall be protected against vibration at all critical movement pivots, slides and so forth.
   c. Differential pressure switches shall be vented to withstand a 50% increase in working pressure without loss of calibration.
   d. Acceptable Manufacturers: Mercoid, Dryer, McDonnell Miller.

2. Electric Low Limit Thermostat (Freeze Stat)
   a. Duct type, fixed 4 deg F(3 deg C) differential, range 32 to 60 deg F(0 to 15 deg C). Sensing element shall be a 20 feet(6m) long capillary tube responding to the lowest temperature sensed along any 12 inches(305 mm) of bulb length. Switch shall be SPDT 120/240 volts AC, rated for 10 amps at 120 volts full load. Unit shall be manually reset. Provide one low limit thermostat for each 20 sq. ft.(1.86 sq. m) or fraction thereof of coil surface area.
   b. Provide DPST switches, 1 NO, 1 NC contact.
   c. Provide manual type low limit thermostat set at 36 deg F(2 deg C) on each air handling unit.
   d. Provide thermostat override on air handling units for smoke control in area being served.

3. Water Flow Switches

a. UL listed, suitable for all service application conditions. Body minimum working pressure rating shall equal or exceed service pressure. Switch electrical rating shall be 230 volts AC 3.7 ampere, 115 volts AC 7.4 ampere, and 125 VAC 115-230 VAC AC Pilot duty. Unit shall have two SPDT switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop exceeding 2 psi at maximum system flow rate.
b. Acceptable Manufacturer: McDonnel-Miller.

4. Strap-On Aquastat
a. UL listed, provided with a suitable removable spring clip for attaching aquastat to pipe and a snap-action SPDT switch. Switch set-point shall be as indicated. Electrical rating shall be 5 amperes, 120 VAC.

5. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

K. Flow, Pressure And Electrical Measuring Apparatus
1. Shielded Static Pressure Sensor
a. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
b. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber with minimum volume of 800 cubic centimeters, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
c. These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 feet/min.(300 m/min) from a radial source.
d. The shielded static sensing devices shall be used for both reference and space pressure sensing.
e. Pressure sensors used for outside air pressure reference purposes shall be equipped with a conduit seal for pneumatic tubing and bushings for a weather tight installation.

2. Static Pressure Traverse Probe
a. Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.
b. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.
c. The duct static traverse probe shall be of 304 stainless steel construction and (except for 3/4" dia. probes with lengths of 24 inches(610 mm) or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure without need for correction factors, with an instrument accuracy of ± 1/2%.
d. Acceptable Manufacturers:
1) Auto Tran

2) Veris
3) Setra

L. Relays And Contactors

1. Relays other than those associated with digital output cards shall be general purpose, enclosed type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.
2. Solid State Relays (SSR): Input/output isolation shall be greater than IOE$^9$ ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10 x 10 E$^6$ operations or greater. The ambient temperature range of SSRs shall be -18 to 140 deg F(-28 To+60 deg C). Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be provided as an integral part of the relay.
3. Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contractor shall be double-break-silver-to-silver type protected by arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.

M. Temperature Control Panels

1. Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Panels shall conform to NEMA 1 standards, unless otherwise indicated.
2. Control panels shall meet all requirements of UL508A and shall be so certified.
3. All external wiring shall be connected to terminal strips mounted within the panel.
4. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels and the identification number of the panel.
5. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

N. Variable Frequency Drives

1. Furnish Variable Frequency Drives (VFD) for installation by the electrical contractor (Div. 16). Drives shall be factory equipped with a LonTalk FTT-10A communications interface.
2. The variable frequency drive (VFD) shall generate the required variable frequency through three main input voltage lines connected to an LC filter and diode bridge. This shall produce a DC voltage for an insulated gate bi-polar transistor (IGBT) bridge. The IGBT bridge shall produce a pulse-width modulated (PWM) AC voltage for the motor. A microprocessor shall control the motor according to measured signals and control commands sent from the VFD control panel.
3. The VFD enclosure shall be INSERT ENCLOSURE TYPE (NEMA 1, NEMA 12, OPEN CHASSIS).
4. VFD shall be suitable for INSERT DESIRED VOLTAGE RANGE (208-240 VAC, 380-500 VAC, or 525-690 VAC). The VFD shall maintain functionality from -15% to +10% of nominal voltage at a frequency of 45-66 Hz. Ambient operating temperature range shall be 14 F to 104 F, and the humidity range: 5 to 95% RH (non-condensing).
5. The VFD shall accommodate inputs of 0-10 VDC, 4-20 mA, up to six digital inputs. VFD outputs shall include current of 0-20 mA, 500 ohm maximum with 10 bit resolution, and two programmable changeover relay outputs with switching capacity of 24 VDC, 8A; 250 VAC, 8A; and 125 VDC, 0.4A.
6. The VFD shall accommodate Modbus, LonTalk, and BACnet communications protocols for field bus control.

7. The variable frequency drive shall have separate pre-loaded user-programmable applications which can be modified using a personal computer-based commissioning tool with an optional software package, or an alpha-numeric LCD user interface. Aforementioned application functionality shall include but not be limited to:
   a. Basic Functionality Application providing the following:
      1) Control I/O signals (two (2) analog inputs, one (1) digital input, and one (1) analog output) are fixed
      2) One (1) programmable digital input and one (1) programmable digital output
      3) All parameters have default values,
      4) No more than nine (9) parameter settings are required for startup and operation.
   b. Expanded Functionality Application providing all capabilities in the previous application as well as the following:
      1) One (1) programmable digital input and all outputs are programmable
      2) Frequency limit and prohibit capability
      3) Programmable start/stop and reversing logic
      4) Automatic restart
      5) Programmable actions for motor thermal and stall protection
      6) DC brake at stop
   c. Application that provides all previously mentioned capability as well as enabling the use of two different control and frequency sources. Each source must be programmable.
   d. Application which provides all functionality from the Expanded Functionality Application as well as accommodates multiple, required fixed speed references.
   e. PID Control Application – Uses internal PID control loop to control motor frequency as well as providing:
   f. Input and output phase supervision
   g. Programmable capability for three (3) digital inputs and all outputs
   h. Sleep function
   i. Multi-purpose Control Application – The frequency reference can be selected from analog inputs, joystick control, motor potentiometer, or a mathematical function of the analog inputs.
   j. Application specifically designed to control one leading variable speed drive and up to 3 auxiliary drives.

8. Variable frequency drives shall be UL listed and sized for the power and loads applied.
9. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used.
10. All VFDs over 3 horsepower shall be provided with an AC choke before rectifiers. All included chokes and filters shall be integrated in the factory enclosure.
11. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.
12. VFD automatic operation shall be suitable for 4-20 ma input signal. Each VFD shall be fan cooled and have an integral keypad and alphanumeric "plain-language" display unit for user interface. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).

13. Three types of faults shall be monitored, “FAULT” shall shut the motor down, “FAULT Auto-reset” shall shut the motor down and try to restart it for a programmable number of tries, and “FAULT Trip” shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:
    a. Over current
    b. Over voltage
    c. Earth ground
    d. Emergency stop
    e. System (component failure)
    f. Under voltage
    g. Phase missing
    h. Heat sink under temperature
    i. Heat sink over temperature
    j. Motor stalled
    k. Motor over temperature
    l. Motor underload
    m. Cooling fan failure
    n. Inverter bridge over temperature
    o. Analog input control under current
    p. Keypad failure
    q. Other product unique monitored conditions

14. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds),output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.
15. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of faults, frequency, unit temperature, and motor speed, current, torque, power, voltage, and temperature.
16. Acceptable manufacturers:
    a. ABB
    b. Honeywell
    c. Square D

O. Any automatic control dampers not specified to be integral with other equipment. Frames shall not be less than 0.094 inch(2.39 mm) galvanized steel. Blades shall not be over 8 inches(200 mm) wide nor less than 0.063 inch(1.52 mm) galvanized steel roll formed. Bearings shall be oilite, ball-bearing or nylon with steel shafts. Side seals shall be stainless steel of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of -40 to 200 deg F(-40 to 93 deg C).

1. Individual damper sections shall have a maximum of 16 sq. ft.(1.49 sq. m) of damper surface and each individual damper section to have its own damper operator.
2. All proportional control dampers shall be opposed blade type and all two-position dampers shall be parallel blade types.
3. Dampers shall be sized to meet ductwork or opening size.

4. Dampers shall be ultra-low leakage dampers and the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 6 CFM per square foot for dampers in excess of sixteen inches square at 1-inch wg(250 Pa).

P. Thermally Isolated Dampers: Tampco Series 9000 or equivalent extruded aluminum thermally isolated control dampers with insulated air-foiled shaped blades.

Q. Digital Wall Module: Each wall module shall provide temperature indication to the digital controller.

1. Provide software-limited set point adjustment and occupied/unoccupied override capability where indicated.
2. Module mounted adjustments shall use buttons, no slides or wheels.
3. Where indicated, provide plate type security temperature sensors.
4. LCD display of temperate, humidity, and setpoints

R. Wireless Temperature Transmitter: Module shall provide temperature indication to the digital system.

1. Supply Power: Lithium batteries, 8 year battery life at 10 second transmit rate
2. Inputs: Built in thermistor
3. Accuracy: ±0.2 °C
4. Transmitted Range: -40° to 85°C
5. Environmental Operation Range:
   a. Temp: 0° to 60°C
   b. Humidity: 5% to 95% RH non-condensing
6. Material: ABS Plastic
7. Material Rating: UL94 V-0
8. Radio Frequency: 418 MHz
9. Transmitter Interval: ~10 seconds
10. Antenna: Built inside the enclosure
11. Associated Products:
    a. 418 or 900 MHz Receivers: Receives the RF signal from one or more transmitters or repeaters and outputs the values to Analog Output Modules.
    b. Analog Output Modules: Converts the signal from the Receiver into a resistance, voltage or current for sending to the controller.
    c. Repeater: Extends the range of the Transmitter up to 1,000 feet.

S. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under Ul-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BMS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output valves shall be hard-wired inputs to the BMS or shall be communicated to the BMS over the open-protocol LAN.

T. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be ± 2% of actual reading from 0.4 to 20 feet per second(0.12 to 6.1 meters per second) flow velocities.

U. Duct smoke detectors shall be furnished and connected to the building fire alarm under Division 28. Contacts shall be provided for the BMS contractor to connect for fan shutdown as specified in the Sequence of Operations.

V. Carbon Monoxide sensor/transmitter shall be American Gas Safety (AGS) COiS-PSAor approved equal. Electrochemical type sensor with 1 A. volt-free BMS relay outputs. Measuring range: 0-300 PPM CO, ABS housing, , capable of covering up to 50 ft. radius (15 m.). Sensors shall be mounted 5 ft. 6 in. (1.68 m.) above finished floor where indicated on drawings.

W. Nitrogen Dioxide sensor/transmitter shall be American Gas Safety (AGS) NOiS-PSA or approved equal. Electrochemical type sensor with 1 A. volt-free BMS relay outputs. Measuring range: 0-20 PPM, ABS housing, capable of covering up to 50 ft. radius (15 m.). Sensors shall be mounted 12 inches(305 mm) above finished floor where indicated on drawings.

X. Carbon Dioxide sensors shall be 0-10 Vdc analog output type, with corrosion free gold-plated Non-dispersive Infrared sensing, designed for duct mounting. Sensor shall incorporate internal diagnostics for power, sensor, analog and output checking, and Automatic Background Calibration algorithm for reduced maintenance. Sensor range shall be 0-3000 PPM with +/- 5% and +/- 50 PPM accuracy.

Y. Outside Air Inlet Airflow Probes:

1. Provide on outside air dampers bead-in-glass thermistor airflow probes capable of continuously measuring the outside air volume.
   a. The airflow probes shall be factory calibrated to NIST traceable standards and use thermal dispersion technology.
   b. The airflow traverse probes shall not significantly impact fan performance or contribute to fan generated noise levels.
   c. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 2% of actual reading.

2. Include matching factory transmitter with an accuracy of ±0.5% of Natural Span and be furnished with a built-in 3-way zeroing valve, user selectable square root function, and integral 3-1/2 digit scalable LCD for display of measured process. The Transmitter shall be housed in a NEMA 1 NEMA 4 enclosure with universal 1/8" FPT signal connection ports, and provide 0-5 volt, 0-10 volt, or 4-20ma output signals for use by the building control system.
3. Include matching factory transmitter with an accuracy of ±0.5% of Natural Span and be furnished with a built-in 3-way zeroing valve, user selectable square root function, and integral 3-1/2 digit scalable LCD for display of measured process. The Transmitter shall be housed in a NEMA 1 enclosure with universal 1/8" FPT signal connection ports, and provide 0-5 volt, 0-10 volt, or 4-20ma output signals for use by the building control system.
4. The airflow probes shall be the Ebtron “Gold” Series with class “C” density.

Z. Supply Air fan Inlet Airflow Probes:

1. Provide bead-in-glass thermistor airflow probes on AHU supply fan inlets capable of continuously measuring the supply air volume.
   a. The airflow probes shall be factory calibrated to NIST traceable standards and use thermal dispersion technology.
   b. The airflow traverse probes shall not significantly impact fan performance or contribute to fan generated noise levels.

c. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 2% of actual reading.

2. Include matching factory transmitter with an accuracy of ±0.5% of Natural Span and be furnished with a built-in 3-way zeroing valve, user selectable square root function, and integral 3-1/2 digit scalable LCD for display of measured process. The Transmitter shall be housed in a NEMA 1 enclosure with universal 1/8" FPT signal connection ports, and provide 0-5 volt, 0-10 volt, or 4-20ma output signals for use by the building control system.
3. Include matching factory transmitter with an accuracy of ±0.5% of Natural Span and be furnished with a built-in 3-way zeroing valve, user selectable square root function, and integral 3-1/2 digit scalable LCD for display of measured process. The Transmitter shall be housed in a NEMA 1 enclosure with universal 1/8" FPT signal connection ports, and provide 0-5 volt, 0-10 volt, or 4-20ma output signals for use by the building control system.
4. The airflow probes shall be the Ebtron “Gold” Series with class “C” density.

AA. Airflow Measuring System (Duct Mounted Configuration): Provide where indicated, bead-in-glass thermistor airflow measuring stations capable of continuously monitoring the duct airflow they serve. Each airflow measuring station shall consist of an airflow measuring station and a transmitter.

1. Each airflow traverse probe mounted within the station shall contain multiple total and static pressure sensors located along its exterior surface, and internally connected to their respective averaging manifolds.
2. The airflow measuring stations shall have a galvanized steel, 6" deep casing with 90º connecting flanges. Total and static pressure sensors shall be located at the centers of equal areas (for rectangular ducts) or at equal concentric area centers (for circular ducts) across the stations face area.
3. Stations shall be AMCA certified and be capable of measuring the airflow rates within an accuracy of ±2% without the use of correction factors. The maximum allowable unrecovered pressure drop caused by the station shall not exceed .025" w.c. at 2000 FPM, or .085" w.c. at 4000 FPM.
4. The Transmitter shall have an accuracy of ±0.5% of Natural Span and be furnished with a built-in 3-way zeroing valve, user selectable square root function, and integral 3-1/2 digit scalable LCD for display of measured process. The Transmitter shall be housed in a NEMA 1 aluminum enclosure with universal 1/8" FPT signal connection ports, and provide 0-5 volt, 0-10 volt, or 4-20ma output signals for use by the building control system.
5. The airflow probes shall be the Ebtron “Gold” Series with class “C” density.

## 2.20 NATURAL GAS FLOW METER

A. Provide an ONICON Model F-5100 or equivalent insertion thermal mass flow meter, complete with all installation hardware for insertion and removal of the meter without system shutdown. Materials of construction for metal components in contact with gas shall be 316 stainless steel. The flow meter shall provide SFPM flow readings from a pair of encapsulated platinum sensors and shall not require additional temperature or pressure compensation. In addition, the meter shall continuously display information that can be used to validate the calibration of the meter. Each flow meter shall be individually wet-calibrated against a standard that is directly traceable to NIST. Include certificate of calibration with each flow meter.

B. Accuracy shall be within ± 1% of rate from 500-7000 SFPM and ± 2% of rate from 100-7000 SFPM. Overall turndown shall exceed 1000:1. Output signals shall consist of the following: (1) analog 4-20mA

output and (1) scalable pulse output for totalization. The meter shall be equipped with an integrally mounted graphical display.

## PART 3 - EXECUTION

### 3.1 GENERAL

A. The BMS shall be designed, installed, and commissioned in a turnkey operational manner; including all labor not noted in Work by Others paragraph of PART I of this section of these specifications, and not noted in other sections of these specifications.

B. Where control devices are installed on insulated piping or ductwork, provide standoff brackets or thermowells sized to clear insulation thickness. Provide extended sensing elements, actuator linkages, and other accessories as required.

### 3.2 SEQUENCE OF OPERATION

A. Refer to drawings for sequence of operations.

### 3.3 INSTALLATION

A. All controls Installer work shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work.

B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

C. Drawings of BMS are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative to the complete satisfaction of the Engineer shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown, specified, or shown on the control diagrams shall be furnished and installed by the controls Installer in accordance with these specifications.

E. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

F. All wiring and tubing shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All tubing and wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

1. Low voltage system cables shall be neatly routed and independently supported with cable rings to the nearest cable tray, technology closet, conduit run or equipment connection.
2. All wiring in ceiling plenums shall be plenum rated.

G. This contractor shall provide all sensing, control, and interlock wiring and tubing for the following unless shown or specified elsewhere by others:

1. Boiler interlocks.
2. Condensing units interlocks.
3. Hydronic piping pressure sensors.
4. CO2 sensors.
5. Connection between occupancy sensors provided by Division 26 and control devices.
6. Smoke detection devices and HVAC equipment shut-down devices.

H. The controls contractor shall install all software and enter all computer data into the network area controllers, hardware, and related computers including all control programs, initial approved parameters and settings, and graphics.

I. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 40 inches(1016 mm) above the floor.

J. For airflow monitoring devices, perform the following field tests and inspections and prepare test reports:

1. Operational Test: After substantial completion of airflow system, start units to confirm proper operation and readings. Remove and replace malfunctioning units and retest.
2. Test calibration to confirm proper operation and readings.

K. Install natural gas flow meter at gas service entrance to measure whole facility gas usage, include emergency generator.

L. Connect to electrical power monitor at main power service entrance disconnect to measure whole facility electrical usage.

## 3.4 ACCEPTANCE

A. The BMS contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations.

1. Coordinate with other Installers the checkout of each controlled system

B. The controls Installer shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the controls Installer has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.5 TRAINING (ALTERNATE 1)

A. All training shall be by the BMS Installer and shall utilize operators' manuals and as-built documentation.

B. The controls Installer shall provide 40 hours of instruction to the Owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; device programming software, graphical development software, graphical user interface, the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Owners' personnel can start to familiarize themselves with the system before training begins.
2. Follow-Up Training: Two one day sessions (8 hours each) after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
3. Warranty Follow Up: Two one day sessions (8 hours each) to be scheduled at the request of the Owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

D. On-Line Service: Include 40 hours of on-line service assistance to include but not be limited to:

1. Programming changes or modifications, including changes and adjustments to control algorithms
2. Graphic changes or modifications as requested by the Owner or consulting engineer.
3. Operator assistance to include short (1 hour or less) refresh training on system diagnostics and operation, i.e., geothermal optimization, scheduling, trending or operator setup.
4. Consulting engineer assistance to include assistance on control system optimization.

3.6 POINTS LIST

A. Refer to drawings for points list. Provide all additional points as required to accomplish all BMS sequences indicated in the drawings and specifications.

**END OF SECTION 23 0900**

**SECTION 28 3100 - FIRE DETECTION AND ALARM**
**Addendum No. 1**
**10-03-2024**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.

B. Related Sections include the following:

1. Division 08 Section "Door Hardware".

1.2 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

D. NICET: National Institute for Certification in Engineering Technologies.

1.3 SYSTEM DESCRIPTION

A. General: Noncoded, analog-addressable system with manual and automatic alarm initiation; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.4 SUBMITTALS

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

B. Shop Drawings:

1. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire alarm system design.
b. Fire alarm certified by NICET, minimum Level III.

2. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
3. Battery: Sizing calculations.
4. Floor Plans: Indicate final outlet locations and routings of raceway connections.

5. Alarm Characteristics: Indicate the visual strobe candela and audible sound level requirements to satisfy NFPA 72 and the Authority having jurisdiction.
6. Device Address List: Coordinate with final system programming.
7. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

C. Operating Instructions: For mounting at the FACP.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.

F. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 01. Comply with NFPA 72.

G. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 01 Section "Submittal Procedures," make an identical submission to authorities having jurisdiction, (Department of Labor & Economic Growth, Office of Fire Safety, P.O. Box 30254, Lansing, Michigan, 48909). Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

H. Certificate of Completion: Comply with NFPA 72.

I. Comply with NFPA 20 for fire pump installations.

J. Inspector's qualifications for the smoke control system.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.

D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.

E. Comply with NFPA 72.

1.6 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment and restore damaged surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Edwards Systems Technology; Unit of General Signal.
2. Faraday, Inc.
3. National Time and Signal Corporation.
4. Notifier; a GE-Honeywell Company
5. Siemens Building Technologies, Inc.; a Cerberus Division.
6. SimplexGrinnell, a subsidiary of Johnson Controls Incorporated

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Control of System: By the FACP.

B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. Noninterference: A signal from one device shall not prevent the receipt of signals from other devices.

E. System Reset: All devices are manually resettable from the FACP after initiating devices are restored to normal.

F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.

G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.

H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.

I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:

1. Notification-appliance operation.
2. Identification at the FACP and the remote annunciator of the device originating the alarm.
3. Transmission of an alarm signal to the remote alarm receiving station.
4. Unlocking of electric door locks in designated egress paths.
5. Release of fire and smoke doors held open by magnetic door holders.
6. Shutdown of fans and other air-handling equipment serving area when alarm was initiated.
7. Closing of smoke dampers in air ducts of system serving area where alarm was initiated.
8. Recording of the event in the system memory.
9. Recording of the event by the system printer.

J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices reactivate notification appliances until silencing switch is operated again.

K. Water-flow alarm switch operation initiates the following:

1. Notification-appliance operation.
2. Flashing of the device location-indicating light for the device that has operated.

L. Smoke detection for detectors with alarm verification initiates the following:

1. Audible and visible indication of an "alarm verification" signal at the FACP.
2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Recording of the event by the system printer.
4. General alarm if the alarm is verified.
5. Cancellation of the FACP indication and system reset if the alarm is not verified.

M. Sprinkler valve-tamper switch operation initiates the following:

1. A supervisory, audible, and visible "valve-tamper" signal indication at the FACP and the annunciator.
2. Flashing of the device location-indicating light for the device that has operated.
3. Recording of the event by the system printer.
4. Transmission of supervisory signal to remote alarm receiving station.

N. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system initiates the following:

1. A supervisory, audible, and visible "sprinkler trouble" signal indication at the FACP and the annunciator.
2. Flashing of the device location-indicating light for the device that has operated.
3. Recording of the event by the system printer.

4. Transmission of trouble signal to remote central station.

O. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.

P. Removal of an alarm-initiating device or a notification appliance initiates the following:

1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
2. Recording of the event by the system printer.
3. Transmission of trouble signal to remote alarm receiving station.

Q. Printout of Events: On receipt of the signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printout of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

R. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

## 2.3 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

1. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm. Break glass/plastic stations are not acceptable.
2. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.
4. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

## 2.4 SMOKE DETECTORS

A. General: Include the following features:

1. Operating Voltage: 24-V dc, nominal.
2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric Smoke Detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Integral Thermal Detector: Fixed-temperature type with 135 deg F (57 deg C) setting.

C. Duct Smoke Detector: Photoelectric type.

1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Motor shutdown wiring by Temperature Control Supplier.

## 2.5 OTHER DETECTORS

A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate of rise of temperature that exceeds 15 deg F (8.3 deg C) per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.6 NOTIFICATION APPLIANCES

A. Description: Equip for mounting as indicated and have screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch (25-mm-) high letters on the lens. Beige or Ivory color.

1. Rated Light Output: 15, 30, 75, or 110 candela, as required to satisfy NFPA 72 requirements.
2. Strobe Leads: Factory connected to screw terminals.
3. Strobes shall be sychronized.

C. Voice/Tone Speakers:

1. High-Range Units: Rated 2 to 15 W.
2. Low-Range Units: Rated 1 to 2 W.
3. Mounting: Flush, semirecessed, surface, or surface-mounted; bi-directional as indicated.
4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

D. Fire Connection Strobe: Provide all required connections to the strobe/horn associated with the fire fighters hose connection on the exterior of the building. Provide 120V power from nearest panel for devices provided by sprinkler system supplier. Connect to emergency power when available.

## 2.7 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

## 2.8 MAGNETIC DOOR HOLDERS

A. Provide wiring for magnetic door holders furnished and installed by the door hardware contractor.

## 2.9 PROGRAMMER/TESTOR

A. Provide a programmer/testor for any fire alarm system requiring such a device for programming and maintenance of signal initiation devices. Furnish unit complete with carrying case and instructions.

## 2.10 CENTRAL FACP

A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.

1. Identify each enclosure with an engraved, red, laminated, phenolic-resin nameplate with lettering not less than 1 inch (25 mm) high. Identify individual components and modules within cabinets with permanent labels.
2. Mounting: Flush.

B. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

C. Control Modules: Include types and capacities required to perform all functions of fire alarm systems. Provide 20% spare signal capacity for future alarm devices.

D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Resetting Controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.

F. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Display: Liquid-crystal type, 40 (small projects) or 80 (large projects) characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

G. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control.

1. Display: A minimum of 80 characters; alarm, supervisory, and component status messages; and indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

H. Instructions: Printed or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.11 NOTIFICATION APPLIANCE CIRCUIT (NAC) EXTENDER PANELS

A. Provide NAC panels as required to support notification appliances.

B. Provide layout of proposed NAC panel locations prior to installation.

## 2.12 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test.

1. Mounting: Flush cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

## 2.13 EMERGENCY POWER SUPPLY

A. General: Components include lead acid battery, charger, and an automatic transfer switch.

1. Battery Nominal Life Expectancy: 20 years, minimum.

B. Battery Capacity: Comply with NFPA 72.

1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.

C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.

D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

## 2.14 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.

## 2.15 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled under UL 864 and NFPA 72.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.16 GUARDS FOR PHYSICAL PROTECTION

A. Description: Welded wire mesh of size and shape for the manual stations, smoke detectors, and audio/visual devices located in school gymnasiums, multi-purpose rooms and locker rooms.

1. Factory fabricated and furnished by the manufacturer of the device.
2. Finish: Paint of color to match the protected device.

## 2.17 WIRE

A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

A. Install fire alarm system in accordance with manufacturer's installation drawings and instructions.

B. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Expand, modify, and supplement the existing control equipment as necessary to extend the existing control functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

C. Manual Pull Stations: Mount semiflush in recessed back boxes.

D. Water-Flow Detectors and Valve Supervisory Switches: Connection for each sprinkler valve station required to be supervised.

E. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.

F. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.

G. Smoke Detectors near Air Registers: Install no closer than 60 inches.

H. Duct Smoke Detectors: Comply with manufacturer's written instructions.

1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
2. Install sampling tubes so they extend the full width of the duct.

I. Audible Alarm-Indicating Devices: Install chimes and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm chime or alarm horn.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Horn/strobe at Fire Fighter's Hose Connection: Connect horn/strobe located on the exterior of the building associated with the sprinkler system.

M. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

N. Annunciator: Install with the top of the panel not more than 60 inches above the finished floor.

O. Provide smoke detectors where required for all FACP and NAC panels.

P. Provide power to all FACP and NAC panels. Connect to emergency power when available.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method:

1. Install wiring in raceways except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Route the fire alarm cable in cable tray system when available.
2. Conceal cables and raceways except in unfinished spaces.
3. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
4. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
5. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

H. Provide handle clamps on all circuit breakers feeding fire alarm system components. Handle clamps shall lock the circuit breaker in the “ON” position.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section Identification for Electrical Systems."

B. Install instructions frame in a location visible from the FACP.

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a #8 AWG ground wire from main service ground to the FACP.

B. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

D. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.

B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.

D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.
2. Test all conductors for short circuits using an insulation-testing device.

3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

I. Provide certification of the fire alarm installation. Submit required documents to the Michigan Department of Labor & Economic Growth, Office of Fire Safety.

## 3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

## 3.7 DEMONSTRATION

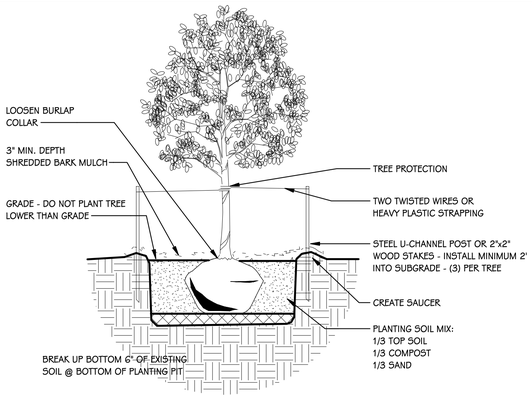
A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.8 ON-SITE ASSISTANCE

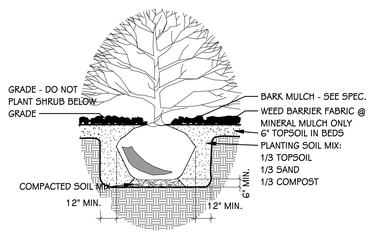
A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

**END OF SECTION 28 3100**




## DECIDUOUS TREE PLANTING DETAIL

1/2" = 1'-0"




## SHRUB PLANTING DETAIL

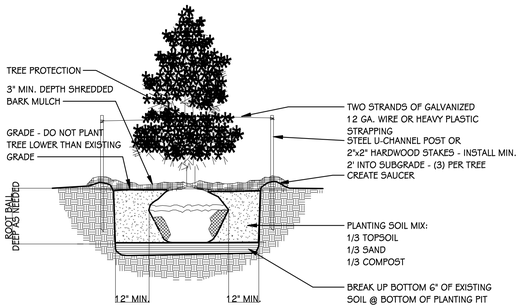
1/8" = 1'-0"

# PLANTING SCHEDULE

| ID | QUANITY | SCIENTIFIC NAME | COMMON NAME | PLANT SIZE | SPACING | TYPE |
|---|---|---|---|---|---|---|
| DECIDUOUS TREE | | | | | | |
| PSG | 5 | PRINCETON SENTRY GINGKO | GINKGO BILOBA PRINCETON SENTRY | 3" CALIPER | AS SHOWN | DECIDUOUS TREE |
| TCG | 4 | TILIA CORDATA 'GREENSPIRE' | GREENSPIRE LITTLELEAF LINDEN | 3" CALIPER | AS SHOWN | DECIDUOUS TREE |
| EVERGREEN TREE | | | | | | |
| JCSG | 6 | JUNIPERUS CHINENSIS 'SEA GREEN' | SEA GREEN JUNIPER | 6'-0" HT. | 5' O.C. | EVERGREEN TREE |
| PPG | 8 | PICEA PUNGENS 'GLAUCA' | COLORADO BLUE SPRUCE | 8'-0"-10'-0" HT. | AS SHOWN | EVERGREEN TREE |
| ORNAMENTAL TREE | | | | | | |
| AGAB | 5 | AMELANCHIER X GRANDIFLORA 'AUTUMN BRILLIANCE' | AUTUMN BRILLIANCE APPLE SERVICEBERRY | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| CA | 5 | CORNUS ALTERNIFOLIA | PAGODA DOGWOOD | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| HM | 5 | HEPTACODIUM MICONIOIDES 'TEMPLE OF BLOOM' | TEMPLE OF BLOOM SEVEN-SON FLOWER | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| PERENNIAL | | | | | | |
| AM | 22 | ALLIUM 'MILLENIUM' | MILLENIUM ALLIUM | 1 GAL. | 1'-6" O.C. | PERENNIAL |
| SNMN | 26 | SALVIA NEMEROSA 'MAY NIGHT' | MAY NIGHT SALVIA | 1 GAL | 2'-0" O.C. | PERENNIAL |
| CVM | 15 | COREOPSIS VERTICILLATA 'MOONBEAM' | MOONBEAM THREADLEAF COREOPSIS | 1 GAL. | 2'-0" O.C. | PERENNIAL |
| NFWL | 10 | NEPETA X FAASSENII 'WALKER'S LOW' | WALKER'S LOW CATMINT | 1 GAL. | 3'-0" O.C. | PERENNIAL |
| SHRUB | | | | | | |
| CAB | 5 | CORNUS ALBA 'BAILHALO' | IVORY HALO DOGWOOD | 5 GAL | 6' O.C. | SHRUB |
| EARH | 12 | EUONYMUS ALATUS 'RUDY HAAG' | RUDY HAAG BURNING BUSH | 3 GAL | 4' O.C. | SHRUB |
| POS | 5 | PHYSOCARPUS OPULIFOLIUS 'SEWARD' | SUMMER WINE NINEBARK | 3 GAL | 4' O.C. | SHRUB |
| SNS | 7 | SPIRAEA NIPPONICA 'SNOWMOUND' | SNOWMOUND SPIREA | 5 GAL | 4' O.C. | SHRUB |
| SJNF | 6 | SPIRAEA JAPONICA 'NEON FLASH' | NEON FLASH JAPANESE SPIREA | 3 GAL | 3' O.C. | SHRUB |
| VD | 8 | VIBUNUM DENTATUM | ARROWWOOD VIBURNUM | 5 GAL | 8' O.C. | SHRUB |

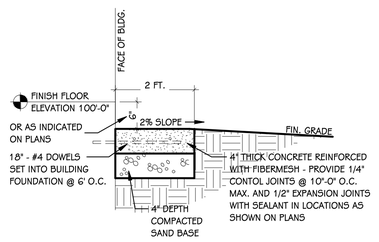
## LANDSCAPE NOTES

1. SCARIFY ALL SUBSOILS PRIOR TO PLACING TOPSOILS AND PLANTING SOILS. TEST ALL TOPSOIL PER SPECIFICATIONS.
2. GUY AND STAKE ALL TREES AND MULCH PER DETAILS. INSTALL WATER BAGS ON ALL TREES. REMOVE BAGS AND GUY STAKES AFTER WARRANTY PERIOD.
3. BACKFILL ALL TREES, SHRUB AND PLANT BEDS WITH PLANTING SOIL PER SPECIFICATIONS AND DETAILS.
4. PROVIDE TEMPORARY WATERING SYSTEM AS REQUIRED TO ESTABLISH LAWN PER SPECIFICATIONS.
5. INSTALL SHREDDED BARK MULCH IN ALL PLANT BENDS AT 3" COMPACTED DEPTH OR AS NOTED OR DETAILED.
6. PROVIDE EROSION CONTROL MATS AS INDICATED ON SOIL EROSION CONTROL PLAN.
7. SEE CIVIL PLANS FOR ALL PAVEMENTS, DETAILS AND LAYOUTS



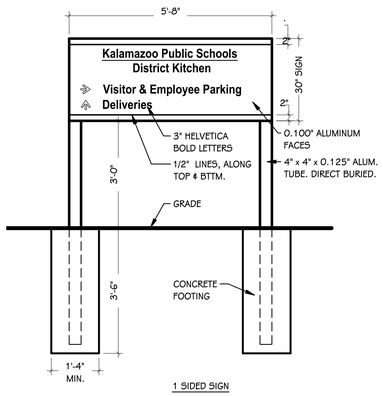

## EVERGREEN TREE STAKING DETAIL

1/8" = 1'-0"



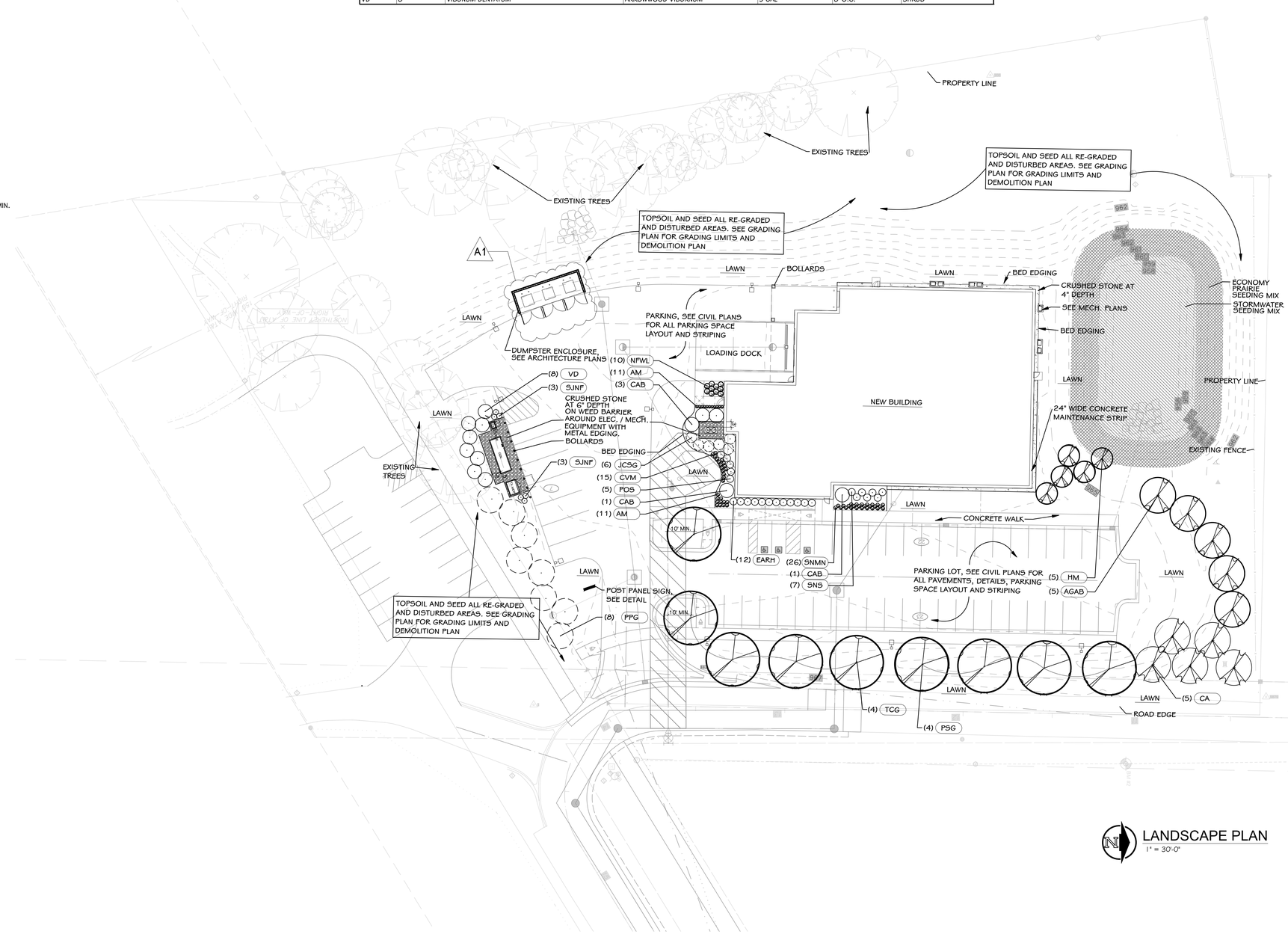

## CONCRETE MAINTENANCE

3/4" = 1'-0"




## POST PANEL SIGN DETAIL

1/2" = 1'-0"




## LANDSCAPE PLAN

1" = 30'-0"

TowerPinkster
Architecture · Engineering · Interiors
4 East Fulton Street, Suite 200
Grand Rapids, Michigan 49503
616.456.9944 PHONE 616.456.5598 FAX
242 East Kalamazoo Avenue, Suite 100
Kalamazoo, Michigan 49007-5828
269.343.6633 FAX
269.343.6133 PHONE
TOWERPINKSTER.COM


ADDENDUM 01 — OCTOBER 7, 2024
ISSUED FOR — DATE

PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

SHEET TITLE
LANDSCAPE PLAN

DATE
September 20, 2024

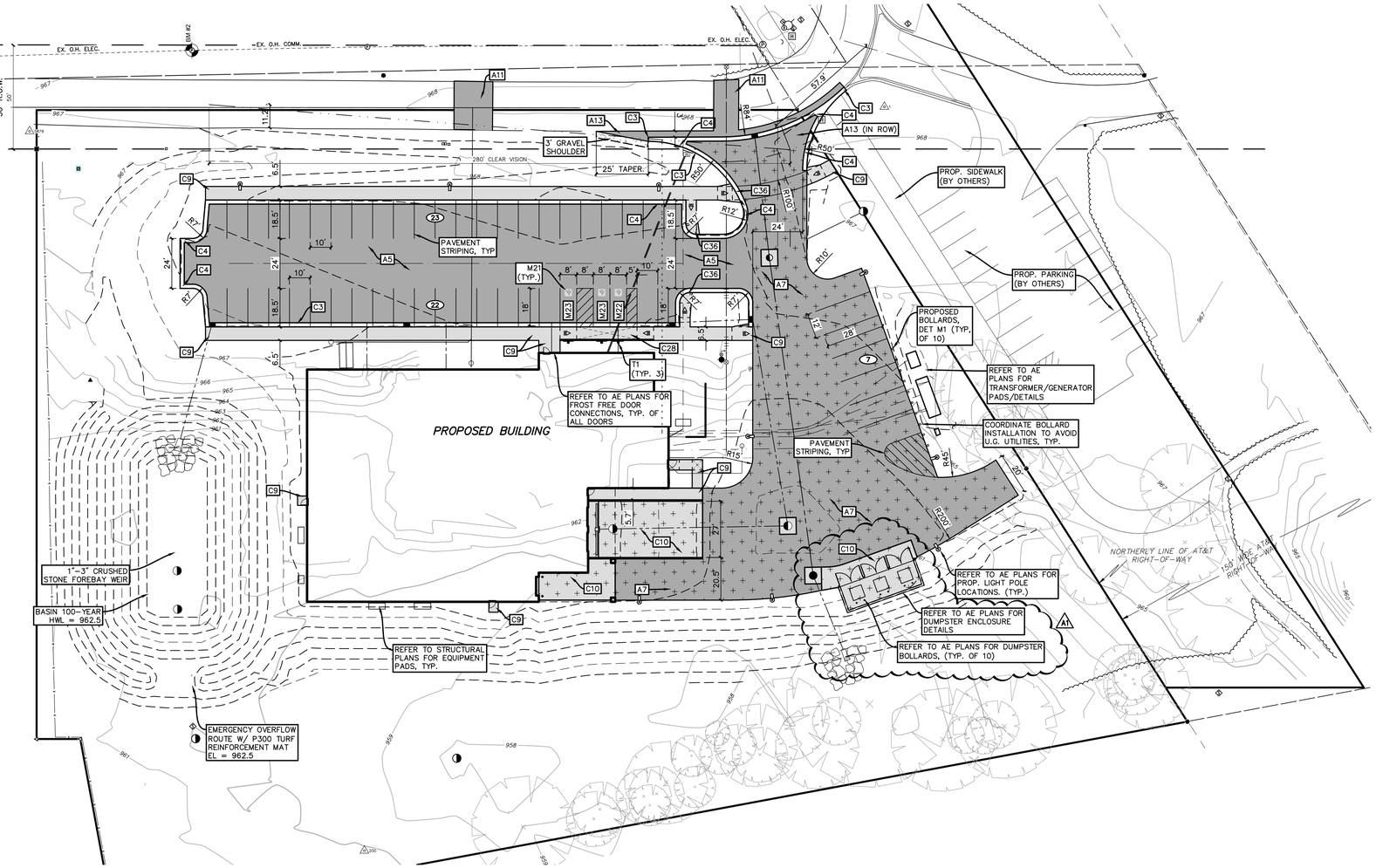
SHEET NUMBER
L 001
18-502.00

B.M. #1 EL. 968.41
FINISH FLOOR OF EXISTING BUILDING JUST INSIDE FRONT MAIN ENTRANCE.

B.M. #2 EL. 968.01
SET LAG BOLT ON WEST SIDE OF UTILITY POLE NEAR THE NORTH END OF THE SCHOOL BUILDING ON THE EAST SIDE OF CHIME STREET AT HOUSE #3493.

VERTICAL DATA BASED ON THE FINISHED FLOOR AT THE MAIN ENTRANCE, NOTED AS BEING ON U.S.G.S. DATUM AND SHOWN ON SURVEY BY INGERSOLL, WATSON & McMACHEN DATED 11/06/90 AT 968.41'.

| | |
|---|---|
| LAND OWNER | = KALAMAZOO PUBLIC SCHOOLS<br>1220 HOWARD STREET<br>KALAMAZOO, MI 49008<br>(269) 337-0100 |
| DESIGNER | = PREIN & NEWHOF<br>JON VERPLANK, PE<br>3355 EVERGREEN DRIVE, NE<br>GRAND RAPIDS, MI 49525<br>(616) 364-8491 |




N

0 30' 60'

SCALE : 1" = 30'

## SITE LAYOUT NOTES

1. SEE ELECTRICAL PLANS FOR LOCATION AND DETAILS ON SITE LIGHTING AND TRANSFORMER.
2. REFER TO SPECIFICATIONS FOR BITUMINOUS PAVEMENT MIX REQUIREMENTS.
3. REFER TO ARCHITECTURAL DRAWINGS FOR CONCRETE STOOP CONNECTION DETAILS AND DUMPSTER ENCLOSURE DETAILS.
4. REFER TO SPECIFICATIONS FOR PAVEMENT EXPANSION AND CONTROL JOINTS.
5. REFER TO MECHANICAL DRAWINGS FOR LOCATION AND DETAILS OF EQUIPMENT PADS.
6. ALL BUILDING WORKING POINTS AND REFERENCE POINTS ARE GIVEN AT THE OUTSIDE CORNER OF BUILDING.
7. COORDINATE WITH IRRIGATION AND ELECTRICAL CONTRACTOR FOR SIZE AND PLACEMENT OF ALL SLEEVES PRIOR TO PAVING, CONCRETE AND RESTORATION WORK.
8. STANDARD PAVEMENT MARKINGS SHALL BE YELLOW. BARRIER FREE PAVEMENT MARKINGS SHALL BE BLUE

## SITE LEGEND LAYOUT

- CONCRETE CURB & GUTTER
- CONCRETE STRAIGHT CURB
- SIGN
- BARRIER FREE RAMP
- BARRIER FREE LANDING
- PARKING AREA STRIPING ISLAND
- STANDARD DUTY CONCRETE PAVEMENT
- STANDARD DUTY BITUMINOUS PAVEMENT
- HEAVY DUTY BITUMINOUS PAVEMENT
- GRAVEL SHOULDER/PAVEMENT
- HEAVY DUTY CONCRETE PAVEMENT
- PARKING STALL COUNT
- LIGHT POLE (REFER TO AE PLANS)

## SITE LAYOUT KEY

| | | |
|---|---|---|
| A5 | STANDARD DUTY BITUMINOUS PAVEMENT | SEE DETAIL A5 |
| A7 | HEAVY DUTY BITUMINOUS PAVEMENT | SEE DETAIL A7 |
| A11 | RCKC COUNTY LOCAL ROAD HMA CROSS SECTION | SEE FIGURE 8 |
| A13 | RCKC COMMERCIAL DRIVEWAY HMA CROSS SECTION | SEE FIGURE 4 |
| C3 | TYPE 1 CONCRETE CURB & GUTTER | SEE DETAIL C3 |
| C4 | TYPE 2 CONCRETE CURB & GUTTER | SEE DETAIL C4 |
| C9 | STANDARD DUTY CONCRETE WALKWAY/PAVEMENT | SEE DETAIL C9 |
| C10 | HEAVY DUTY CONCRETE WALKWAY/PAVEMENT | SEE DETAIL C10 |
| C28 | CONCRETE FLUSH TURNED DOWN WALK | SEE DETAIL C28 |
| C36 | BARRIER FREE CONCRETE WALK RAMP | SEE DETAIL C36 |
| M21 | BARRIER FREE SYMBOL | SEE DETAIL M21 |
| M22 | BARRIER-FREE PARKING SPACE LAYOUT | SEE DETAIL M22 |
| M23 | BARRIER-FREE PARKING SPACE LAYOUT - VAN | SEE DETAIL M23 |
| T1 | BARRIER FREE PARKING SIGN | SEE DETAIL T1 |

## SITE DATA

| | |
|---|---|
| ZONING | = VC-VILLAGE COMMERICAL DISTRICT |
| SITE AREA | = 3.67 ACRE |
| MINIMUM LOT WIDTH | = 65 FEET |
| MIN. FRONT YARD SETBACK | = 5 FEET |
| MIN. SIDE YARD SETBACK | = 0 FEET |
| MIN. REAR YARD SETBACK | = 15 FEET |
| SITE AREA | = 159,865 SFT; 3.67 ACRES |
| CONSTRUCTION SITE AREA | = 106,708 SFT; 2.45 ACRES |
| EXISTING BUILDING | = 26,417 SFT |
| PROPOSED BUILDING | = 17,177 SFT |
| EXISTING IMPERVIOUS | = 63,674 SFT |
| PROPOSED IMPERVIOUS | = 55,312 SFT |
| PARKING SPACE | = 10'x18.5' (185 SFT) |
| PARKING AISLE | = 24 FEET |

EXISTING PARKING = 18 SPACES (1 ADA)
PROPOSED PARKING = 45 SPACES (3 ADA)

811 Know what's below. Call before you dig.

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Prein&Newhof
Engineers • Surveyors • Environmental • Laboratory
#2230345


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242 East Kalamazoo Avenue, Suite 100 Kalamazoo, Michigan 49007-5828 269.343.6133 PHONE 269.343.6833 FAX
TOWERPINKSTER.COM



Addendum No. 01 October 7, 2024
ISSUED FOR: DATE

PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

DATE
SEPTEMBER 20, 2024

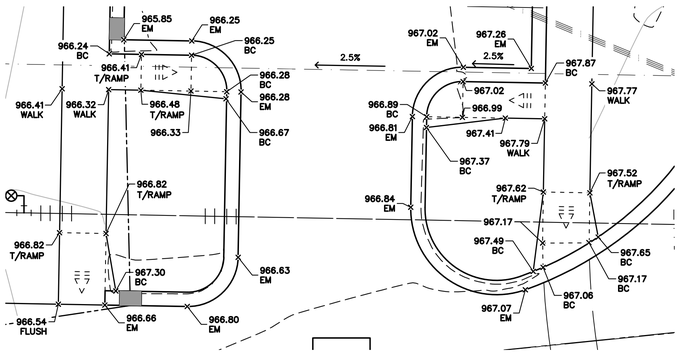
SHEET TITLE
SITE PLAN

SHEET NUMBER
C 200
18-502.00

B.M. #1 EL. 968.41
FINISH FLOOR OF EXISTING BUILDING JUST INSIDE FRONT MAIN ENTRANCE.

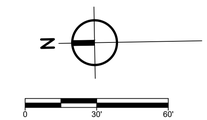
B.M. #2 EL. 968.01
SET LAG BOLT ON WEST SIDE OF UTILITY POLE NEAR THE NORTH END OF THE SCHOOL BUILDING ON THE EAST SIDE OF CHIME STREET AT HOUSE #3493.

VERTICAL DATA BASED ON THE FINISHED FLOOR AT THE MAIN ENTRANCE, NOTED AS BEING ON U.S.G.S. DATUM AND SHOWN ON SURVEY BY INGERSOLL, WATSON & McMACHEN DATED 11/06/90 AT 968.41'.




## ENLARGED SIDEWALK RAMP GRADING

SCALE : 1" = 10'




SCALE : 1" = 30'

## GRADING NOTES

| | | |
|---|---|---|
| CONC | = | TOP OF CONC. |
| EM | = | EDGE OF METAL |
| FFE | = | FINISHED FLOOR ELEVATION |
| FLUSH | = | FLUSH CURB |
| N/A | = | GROUND SPOT |
| HMA | = | BITUMINOUS PAVEMENT |
| FES | = | FLARED END SECTION |
| RIM | = | UTILITY STRUCTURE |
| WALK | = | SIDEWALK |
| BC | = | BACK OF CURB |
| T/RAMP | = | TOP OF SIDEWALK RAMP |
| B/RAMP | = | BOTTOM OF SIDEWALK RAMP |
| T/WALL | = | TOP OF WALL |
| B/WALL | = | BOTTOM OF WALL |

1. ALL SITE STORM WATER WILL BE MAINTAINED ON SITE.
2. REFER TO SPECIFICATIONS FOR ADDITIONAL ABBREVIATIONS FOR CIVIL/SITE AMENITIES.
3. SIDEWALK CROSS-SLOPES HAVE BEEN DESIGNED AT 1.5%, AND MUST NOT EXCEED 1.8%.

## GRADING LEGEND

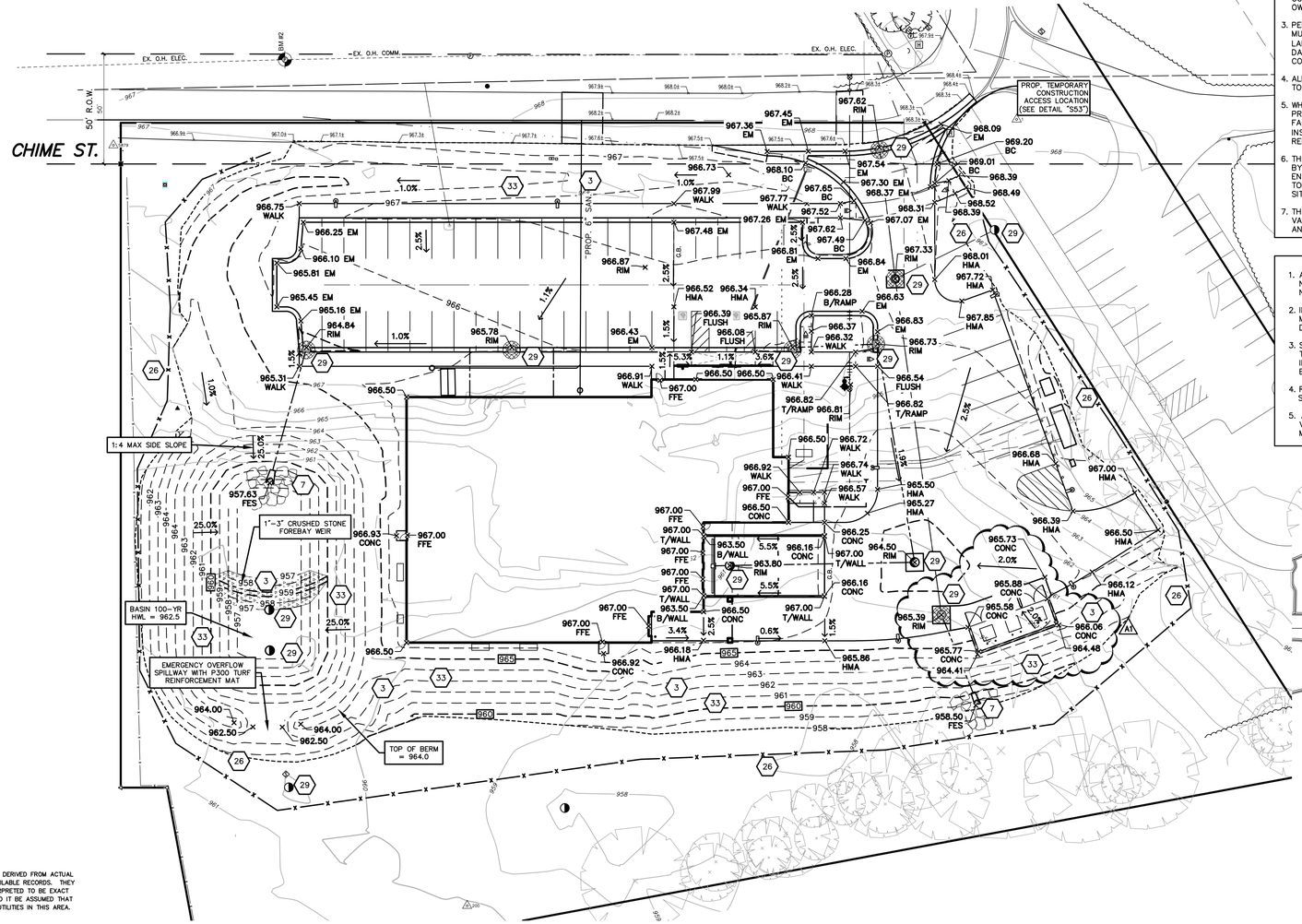
| | |
|---|---|
| SPOT ELEVATION | 780.20 |
| FLOW DIRECTION WITH GRADE | 2.0% |
| SLOPE LABEL | 5:1 |
| CATCH BASIN (EX. \| PROP.) | |
| CULVERT END SECTION W/ RIPRAP | |
| HYDRANT & VALVE (EX. \| PROP.) | |
| MANHOLE (EX. \| PROP.) | |
| CLEANOUT | |
| SWALE/DITCH | |
| GRADE BREAK | |
| PROP. CONTOUR LINE | 780 |
| EX. CONTOUR LINE | 780 |
| GRADING LIMIT | |
| SILT FENCE | x x x |

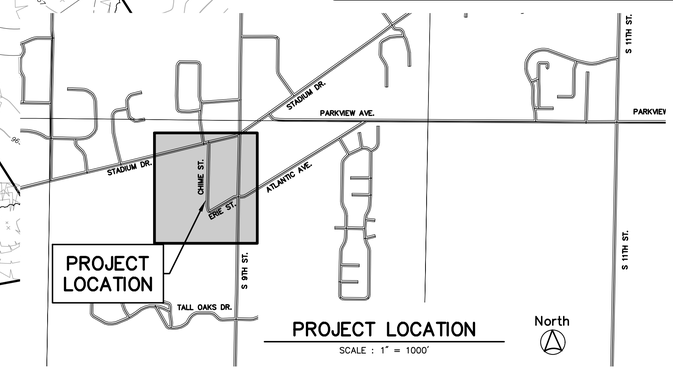
## EROSION CONTROL NOTES

1. THE CONTRACTOR SHALL COMPLY WITH MUNICIPALITY RULES & REGULATIONS FOR SOIL EROSION CONTROL & SUBMIT A SCHEDULE OF SOIL EROSION ACTIVITIES TO THE LOCAL ENFORCING AGENCY PRIOR TO ANY EARTH CHANGE.
2. THE CONTRACTOR SHALL INSPECT ALL TEMPORARY & PERMANENT EROSION CONTROL MEASURES WEEKLY & IMMEDIATELY (WITHIN 24 HOURS) AFTER A SIGNIFICANT RAINFALL EVENT. ALL MEASURES REQUIRING MAINTENANCE REPAIR, OR REPLACEMENT SHALL BE CORRECTED IMMEDIATELY AT NO ADDITIONAL COST TO THE OWNER.
3. PERMANENT SOIL EROSION CONTROL MEASURES, PLANTINGS & MULCHING FOR ALL SLOPES, CHANNELS, DITCHES, OR DISTURBED LAND AREA SHALL BE COMPLETED WITHIN FIVE (5) CALENDAR DAYS AFTER FINAL GRADING OR FINAL EARTH CHANGE HAS BEEN COMPLETED.
4. ALL SLOPES SHALL BE TRACKED PERPENDICULAR TO THE SLOPE TO AID IN EROSION CONTROL OF SLOPED AREAS.
5. WHERE SEASONAL LIMITATIONS OR CONSTRUCTION DELAYS PREVENT SCHEDULED INSTALLATION OF PERMANENT CONTROL FACILITIES, APPROVED TEMPORARY MEASURES SHALL BE INSTALLED WITHIN FIVE (5) CALENDAR DAYS & MAINTAINED UNTIL REPLACED BY PERMANENT FACILITY.
6. THE LOCATION OF ANY TOPSOIL STOCKPILE SHALL BE DESIGNATED BY THE OWNER PRIOR TO CONSTRUCTION. THIS AREA SHALL BE ENCLOSED BY SILT FENCE A REASONABLE DISTANCE FROM THE TOE OF SLOPE UNTIL SUCH TIME IT IS USED TO TOPSOIL THE SITE.
7. THE TOTAL DISTURBED AREA IS 2.5 ACRES. SOILS SHOW A VARIETY OF SANDY SOILS, REFER TO THE GEOTECHNICAL FINDS AND SOIL BORINGS FOR MORE INFORMATION.

## CONSTRUCTION SEQUENCING

1. APPLY FOR & OBTAIN ALL REQUIRED PERMITS INCLUDING BUT NOT LIMITED TO SOIL SEDIMENT CONTROL PERMIT AND STATE NPDES PERMIT BY RULE FOR CONSTRUCTION ACTIVITIES.
2. INSTALL SILT FENCING & PERIMETER SOIL EROSION CONTROL MEASURES INDICATED ON THE PLANS & MAINTAIN AT ALL TIMES DURING CONSTRUCTION.
3. STRIP TOPSOIL AND REMOVE UNSUITABLE MATERIALS UNDER THE PROPOSED HARD SURFACED AREAS. STOCKPILE TOPSOIL IN AN AREA OUTSIDE OF THE IMPROVED AREAS AS DESIGNATED BY THE OWNER.
4. RESTORE ALL DISTURBED AREAS IN ACCORDANCE WITH THE SPECIFICATIONS.
5. AFTER ALL DISTURBED AREAS HAVE BEEN RESTORED & VEGETATION IS ESTABLISHED, REMOVE SOIL EROSION CONTROL MEASURES.




## PROJECT LOCATION

SCALE : 1" = 1000'

North

811 Know what's below. Call before you dig.

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Prein&Newhof
Engineers•Surveyors•Environmental•Laboratory
#2230345


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Kalamazoo, Michigan 49007-5828
269.343.6133 PHONE 269.343.6833 FAX
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Addendum No. 01 October 7, 2024
ISSUED FOR: DATE

PROJECT TITLE
DISTRICT KITCHEN

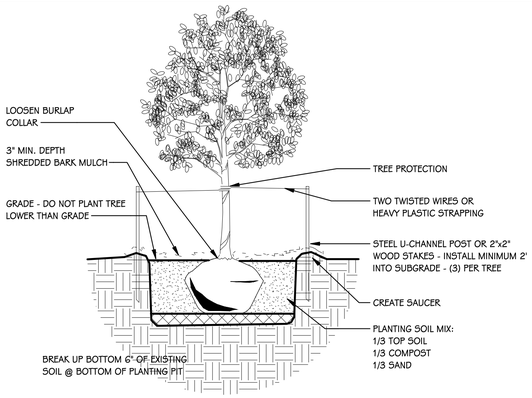
OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
GRADING & SESC PLAN

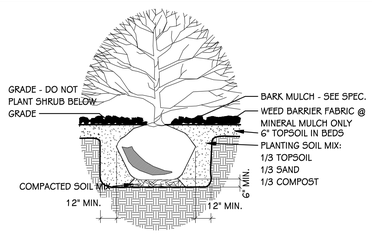
DATE
SEPTEMBER 20, 2024

SHEET NUMBER
C 300
18-502.00




## DECIDUOUS TREE PLANTING DETAIL

1/2" = 1'-0"




## SHRUB PLANTING DETAIL

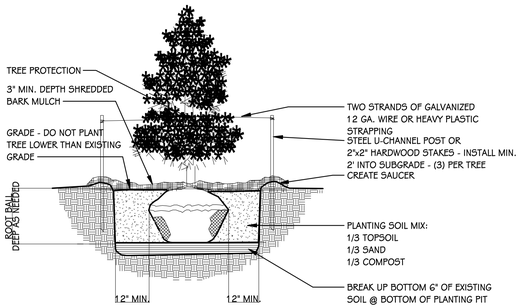
1/8" = 1'-0"

# PLANTING SCHEDULE

| ID | QUANITY | SCIENTIFIC NAME | COMMON NAME | PLANT SIZE | SPACING | TYPE |
|---|---|---|---|---|---|---|
| DECIDUOUS TREE | | | | | | |
| PSG | 5 | PRINCETON SENTRY GINGKO | GINKGO BILOBA PRINCETON SENTRY | 3" CALIPER | AS SHOWN | DECIDUOUS TREE |
| TCG | 4 | TILIA CORDATA 'GREENSPIRE' | GREENSPIRE LITTLELEAF LINDEN | 3" CALIPER | AS SHOWN | DECIDUOUS TREE |
| EVERGREEN TREE | | | | | | |
| JCSG | 6 | JUNIPERUS CHINENSIS 'SEA GREEN' | SEA GREEN JUNIPER | 6'-0" HT. | 5' O.C. | EVERGREEN TREE |
| PPG | 8 | PICEA PUNGENS 'GLAUCA' | COLORADO BLUE SPRUCE | 8'-0"-10'-0" HT. | AS SHOWN | EVERGREEN TREE |
| ORNAMENTAL TREE | | | | | | |
| AGAB | 5 | AMELANCHIER X GRANDIFLORA 'AUTUMN BRILLIANCE' | AUTUMN BRILLIANCE APPLE SERVICEBERRY | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| CA | 5 | CORNUS ALTERNIFOLIA | PAGODA DOGWOOD | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| HM | 5 | HEPTACODIUM MICONIOIDES 'TEMPLE OF BLOOM' | TEMPLE OF BLOOM SEVEN-SON FLOWER | 2 1/2" CALIPER | AS SHOWN | ORNAMENTAL TREE |
| PERENNIAL | | | | | | |
| AM | 22 | ALLIUM 'MILLENIUM' | MILLENIUM ALLIUM | 1 GAL. | 1'-6" O.C. | PERENNIAL |
| SNMN | 26 | SALVIA NEMEROSA 'MAY NIGHT' | MAY NIGHT SALVIA | 1 GAL | 2'-0" O.C. | PERENNIAL |
| CVM | 15 | COREOPSIS VERTICILLATA 'MOONBEAM' | MOONBEAM THREADLEAF COREOPSIS | 1 GAL. | 2'-0" O.C. | PERENNIAL |
| NFWL | 10 | NEPETA X FAASSENII 'WALKER'S LOW' | WALKER'S LOW CATMINT | 1 GAL. | 3'-0" O.C. | PERENNIAL |
| SHRUB | | | | | | |
| CAB | 5 | CORNUS ALBA 'BAILHALO' | IVORY HALO DOGWOOD | 5 GAL | 6' O.C. | SHRUB |
| EARH | 12 | EUONYMUS ALATUS 'RUDY HAAG' | RUDY HAAG BURNING BUSH | 3 GAL | 4' O.C. | SHRUB |
| POS | 5 | PHYSOCARPUS OPULIFOLIUS 'SEWARD' | SUMMER WINE NINEBARK | 3 GAL | 4' O.C. | SHRUB |
| SNS | 7 | SPIRAEA NIPPONICA 'SNOWMOUND' | SNOWMOUND SPIREA | 5 GAL | 4' O.C. | SHRUB |
| SJNF | 6 | SPIRAEA JAPONICA 'NEON FLASH' | NEON FLASH JAPANESE SPIREA | 3 GAL | 3' O.C. | SHRUB |
| VD | 8 | VIBUNUM DENTATUM | ARROWWOOD VIBURNUM | 5 GAL | 8' O.C. | SHRUB |

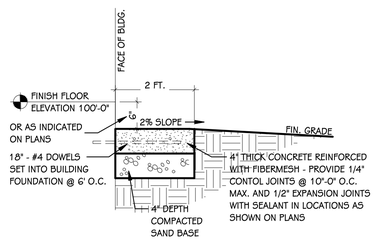
## LANDSCAPE NOTES

1. SCARIFY ALL SUBSOILS PRIOR TO PLACING TOPSOILS AND PLANTING SOILS. TEST ALL TOPSOIL PER SPECIFICATIONS.
2. GUY AND STAKE ALL TREES AND MULCH PER DETAILS. INSTALL WATER BAGS ON ALL TREES. REMOVE BAGS AND GUY STAKES AFTER WARRANTY PERIOD.
3. BACKFILL ALL TREES, SHRUB AND PLANT BEDS WITH PLANTING SOIL PER SPECIFICATIONS AND DETAILS.
4. PROVIDE TEMPORARY WATERING SYSTEM AS REQUIRED TO ESTABLISH LAWN PER SPECIFICATIONS.
5. INSTALL SHREDDED BARK MULCH IN ALL PLANT BENDS AT 3" COMPACTED DEPTH OR AS NOTED OR DETAILED.
6. PROVIDE EROSION CONTROL MATS AS INDICATED ON SOIL EROSION CONTROL PLAN.
7. SEE CIVIL PLANS FOR ALL PAVEMENTS, DETAILS AND LAYOUTS



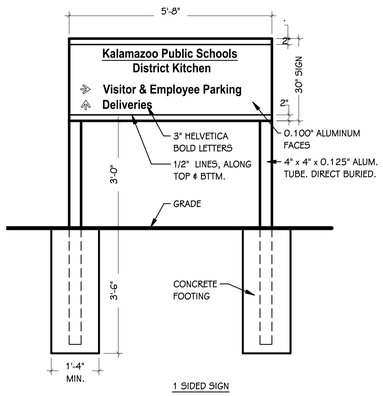

## EVERGREEN TREE STAKING DETAIL

1/8" = 1'-0"



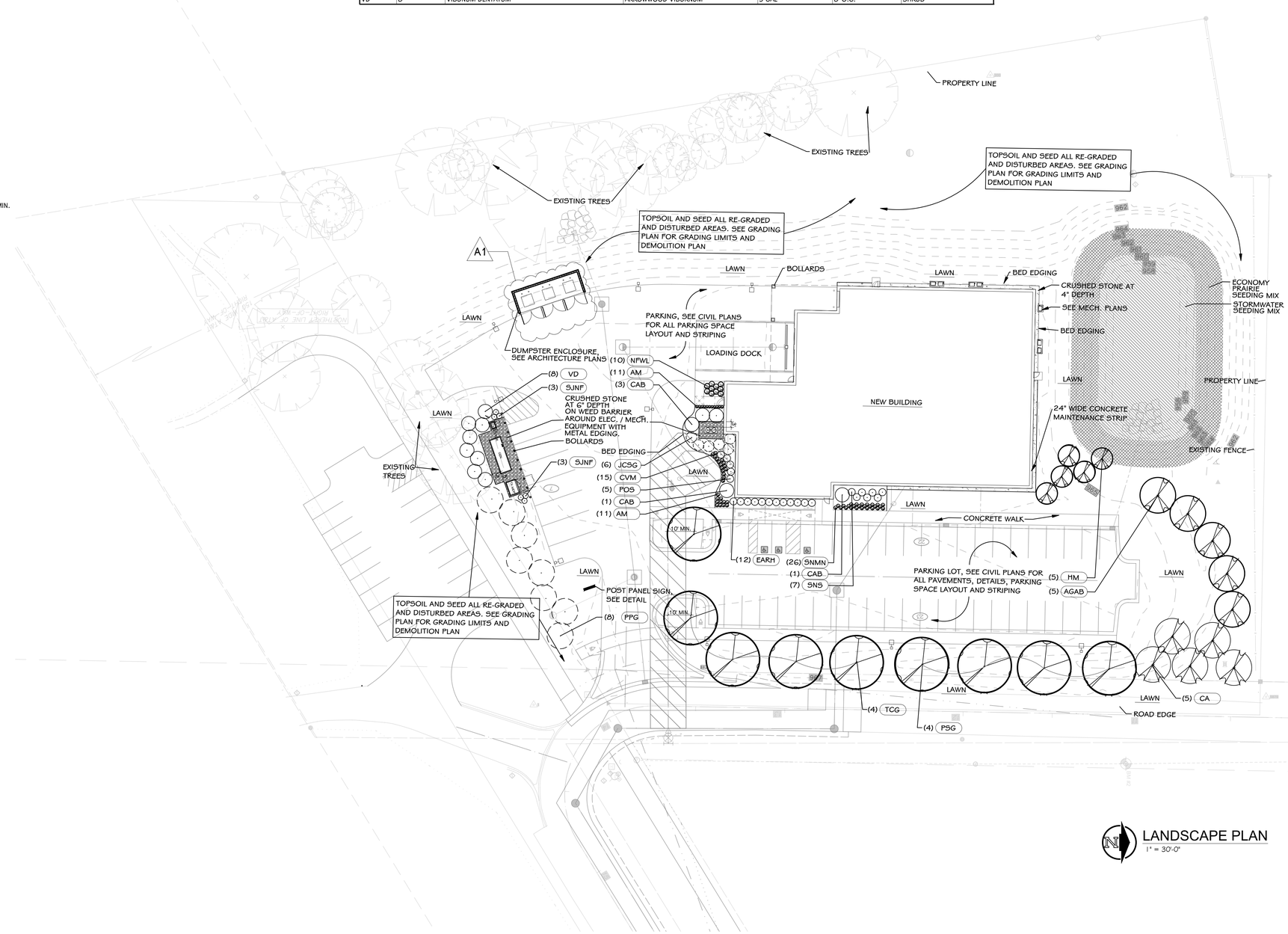

## CONCRETE MAINTENANCE

3/4" = 1'-0"




## POST PANEL SIGN DETAIL

1/2" = 1'-0"




## LANDSCAPE PLAN

1" = 30'-0"

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ADDENDUM 01 — OCTOBER 7, 2024
ISSUED FOR — DATE

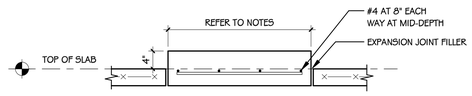
PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

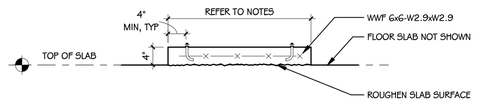
SHEET TITLE
LANDSCAPE PLAN

DATE
September 20, 2024

SHEET NUMBER
L 001
18-502.00




TYPICAL ISOLATION PAD



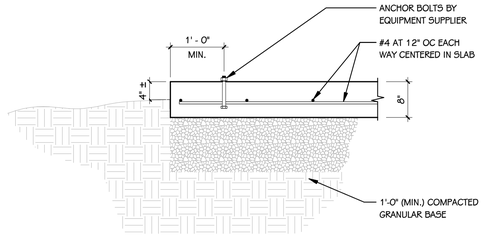

TYPICAL HOUSEKEEPING PAD

NOTES:

1. REFER TO ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR PAD SIZES AND LOCATIONS. COORDINATE QUANTITY AND LOCATION OF EQUIPMENT ANCHOR BOLTS WITH APPROVED SHOP DRAWINGS.
2. PROVIDE EQUIPMENT PAD PLAN DIMENSIONS AS REQUIRED FOR UNIT, COORDINATE REQUIRED DIMENSIONS WITH APPROVED EQUIPMENT SHOP DRAWINGS.

## TYPICAL INTERIOR EQUIPMENT PAD DETAILS

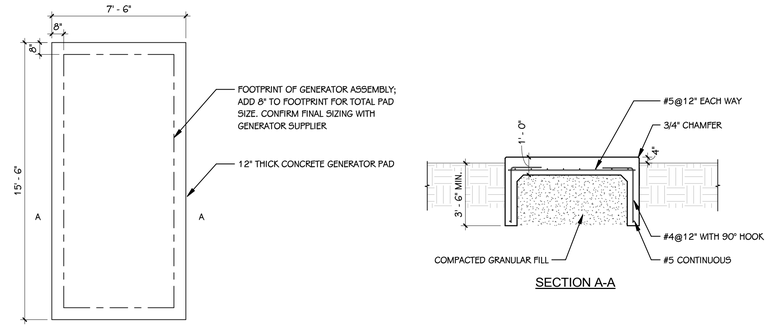
SCALE: NONE




NOTE: PAD SIZE SHALL EXTEND 12" MIN BEYOND THE EQUIPMENT LAYOUT.

## TYPICAL EXTERIOR EQUIPMENT PAD DETAIL

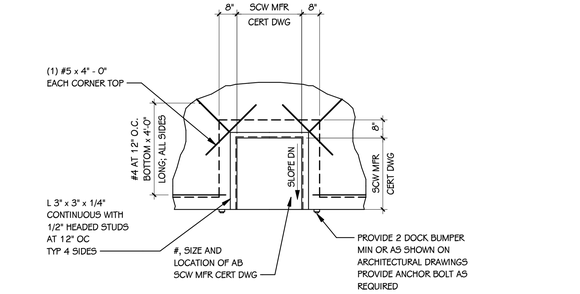
SCALE: NONE



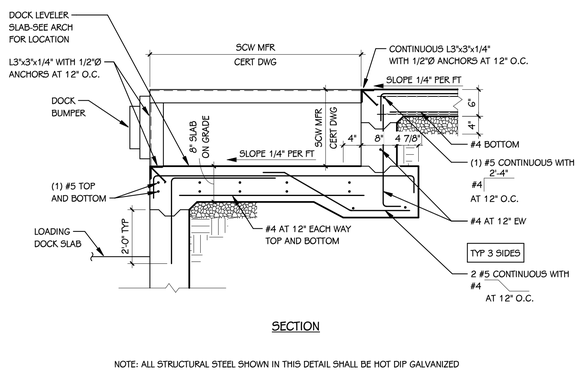

SECTION A-A

## EXTERIOR GENERATOR PAD DETAIL

SCALE: NONE




PLAN

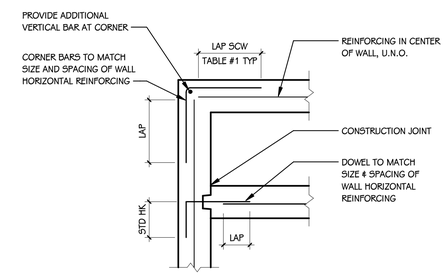



SECTION

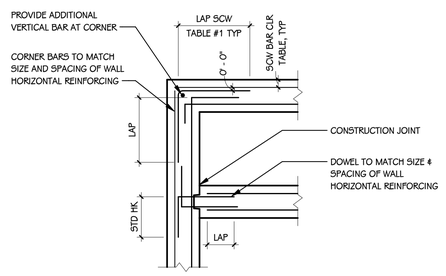
NOTE: ALL STRUCTURAL STEEL SHOWN IN THIS DETAIL SHALL BE HOT DIP GALVANIZED

## TYPICAL DOCK LEVELER FLOOR PLAN

SCALE: NONE



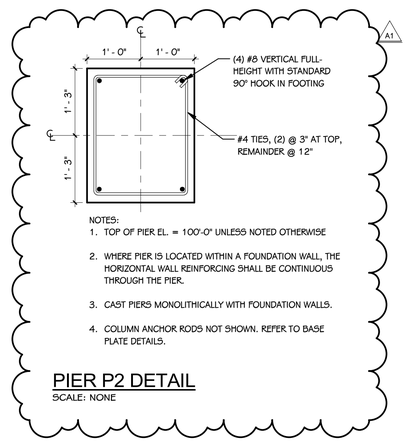

1 LAYER OF REINFORCING




2 LAYERS OF REINFORCING

## TYPICAL CONCRETE WALL CORNER DETAILS

SCALE: NONE




NOTES:

1. TOP OF PIER EL. = 100'-0" UNLESS NOTED OTHERWISE
2. WHERE PIER IS LOCATED WITHIN A FOUNDATION WALL, THE HORIZONTAL WALL REINFORCING SHALL BE CONTINUOUS THROUGH THE PIER.
3. CAST PIERS MONOLITHICALLY WITH FOUNDATION WALLS.
4. COLUMN ANCHOR RODS NOT SHOWN. REFER TO BASE PLATE DETAILS.

## PIER P2 DETAIL

SCALE: NONE

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Addendum No. 1 — October 7, 2024

ISSUED FOR — DATE

PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
TYPICAL FOUNDATION DETAILS

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
S 004
18-502.00

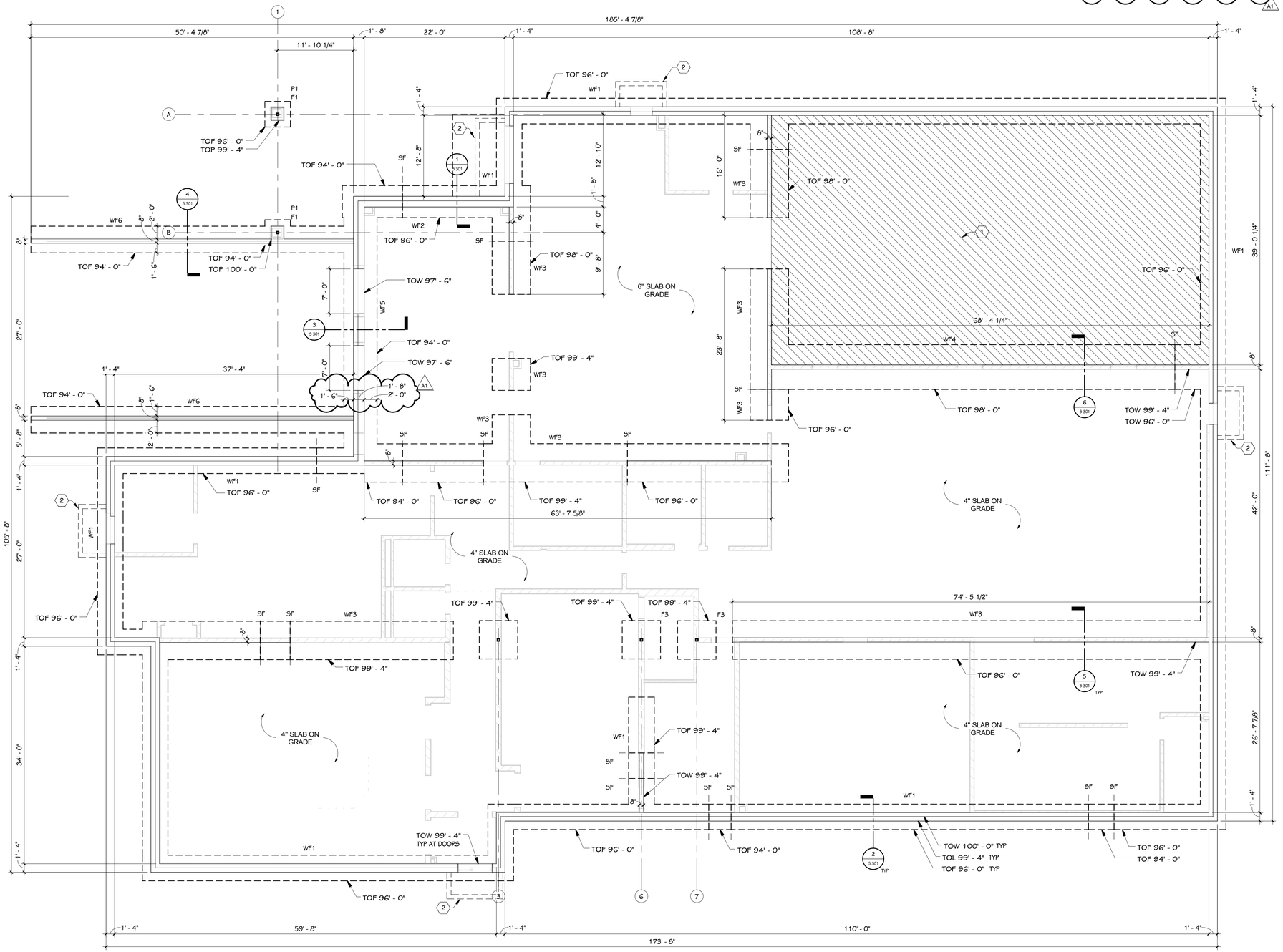
# ISOLATED FOOTING SCHEDULE

| MARK | HEIGHT | WIDTH | LENGTH | FOOTING REINFORCING |
|---|---|---|---|---|
| F1 | 12" | 4' - 0" | 4' - 0" | (4) #5 BOTTOM BARS, EW |
| F3 | 12" | 6' - 0" | 6' - 0" | (6) #5 BOTTOM BARS EW |

# WALL FOOTING SCHEDULE

| MARK | HEIGHT | WIDTH | TRANSVERSE REINFORCING | LONGITUDINAL REINFORCING |
|---|---|---|---|---|
| WF1 | 12" | 4' - 0" | #5 BOTTOM BARS @ 12" OC | (4) #5 BOTTOM BARS |
| WF2 | 12" | 5' - 0" | #5 BOTTOM BARS @ 12" OC | (5) #5 BOTTOM BARS |
| WF3 | 12" | 6' - 0" | #6 BOTTOM BARS @ 12" OC | (4) #6 BOTTOM BARS |
| WF4 | 12" | 7' - 0" | #7 BOTTOM BARS @ 12" OC | (4) #7 BOTTOM BARS |
| WF5 | 12" | 5' - 2" | PER DETAIL | PER DETAIL |
| WF6 | 12" | 4' - 2" | PER DETAIL | PER DETAIL |

A1




## FOUNDATION PLAN
1/8" = 1'-0"

## PLAN NOTES - FOUNDATION

1. UNLESS NOTED OTHERWISE, ALL SLAB ON GRADE SHALL BE 4" THICK CONCRETE WITH WWF 6x6-W1.4xW1.4 OVER VAPOR BARRIER OVER 6" COMPACTED GRANULAR BASE. REFER TO TYPICAL DETAILS ON S 003 FOR ADDITIONAL REQUIREMENTS.
2. PROVIDE THICKENED SLAB BENEATH ALL INTERIOR NON-BEARING MASONRY WALLS. SEE TYPICAL THICKENED SLAB DETAIL. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF INTERIOR NON-BEARING MASONRY WALLS.
3. TOP OF SLAB-ON-GRADE ELEVATION = 100'-0", UNO.
4. TOP OF PIER AND FOUNDATION WALL ELEVATION = 99'-4", UNO.
5. TOP OF FOOTING ELEVATION = 96'-0" UNO. ALL EXTERIOR FOOTINGS TO EXTEND A MINIMUM OF 3'-6" BELOW FINISHED GRADE.
6. TOP OF FOOTING ELEVATION AT INTERIOR FOOTINGS = 99'-4", UNO.
7. TOP OF BRICK LEDGE ELEVATION = 99'-4", UNO.
8. REFER TO GENERAL NOTES FOR DESIGN SOIL BEARING CAPACITY.
9. REFER TO ARCHITECTURAL DRAWINGS FOR INTERIOR WALL DIMENSIONS.
10. VERIFY LOCATIONS OF COLUMNS, WALLS, OPENINGS, ETC. WITH ARCHITECTURAL DRAWINGS BEFORE PLACING FOUNDATIONS.
11. COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, AND UNDER FLOOR PIPES, CONDUITS, DRAINS, DEPRESSIONS, ETC.
12. PROVIDE FROST-FREE ENTRANCE APRON AT ALL EXTERIOR DOORS, REFER TO TYPICAL DETAIL.
13. REINFORCING SHOWN ON PLAN IS IN ADDITION TO REINFORCING SHOWN IN SECTIONS, DETAILS, AND SCHEDULES.

## KEYED NOTES - FOUNDATION

1 INDICATES 6" CONCRETE SLAB OVER 6" RIGID INSULATION OVER 6" CONCRETE SLAB OVER VAPOR BARRIER. REFER TO ARCHITECTURAL FOR ADDITIONAL INFORMATION.
2 REFER TO TYPICAL APRON/ENTRANCE DETAIL.
3 REFER TO CIVIL & LANDSCAPE FOR LOCATION OF DUMPSTER ENCLOSURE ON SITE.
4 ORIENT BASE PLATE WITH THE SHORTER SIDE LOCATED SUCH THAT THE GREATER CLEARANCE TO THE PIPE BOLLARD IS ACHIEVED.

## FOUNDATION PLAN LEGEND

| | |
|---|---|
| TOF | INDICATES TOP OF FOOTING |
| TOW | INDICATES TOP OF WALL |
| TOL | INDICATES TOP OF BRICK LEDGE |
| TOP | INDICATES TOP OF PIER |
| SF | STEPPED FOOTING. REFER TO TYPICAL DETAILS. CREATE EQUAL STEPS BETWEEN ADJACENT TOP OF FOOTING ELEVATIONS. |
| Fx/WFx | ISOLATED FOOTING OR WALL FOOTING DESIGNATION. REFER TO FOOTING SCHEDULES. |
| Px | CONCRETE PIER DESIGNATION. REFER TO TYPICAL PIER DETAILS. |

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PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
FOUNDATION PLAN

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
S 101
18-502.00

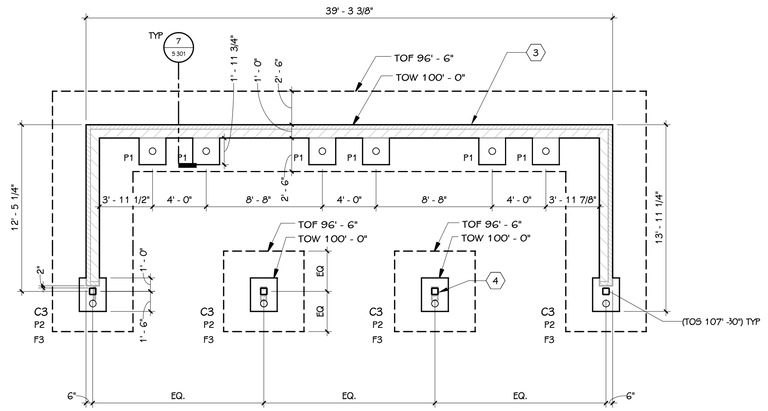
# ISOLATED FOOTING SCHEDULE

| MARK | HEIGHT | WIDTH | LENGTH | FOOTING REINFORCING |
|---|---|---|---|---|
| F1 | 12" | 4' - 0" | 4' - 0" | (4) #5 BOTTOM BARS, EW |
| F3 | 12" | 6' - 0" | 6' - 0" | (6) #5 BOTTOM BARS EW |

# WALL FOOTING SCHEDULE

| MARK | HEIGHT | WIDTH | TRANSVERSE REINFORCING | LONGITUDINAL REINFORCING |
|---|---|---|---|---|
| WF1 | 12" | 4' - 0" | #5 BOTTOM BARS @ 12" OC | (4) #5 BOTTOM BARS |
| WF2 | 12" | 5' - 0" | #5 BOTTOM BARS @ 12" OC | (5) #5 BOTTOM BARS |
| WF3 | 12" | 6' - 0" | #6 BOTTOM BARS @ 12" OC | (4) #6 BOTTOM BARS |
| WF4 | 12" | 7' - 0" | #7 BOTTOM BARS @ 12" OC | (4) #7 BOTTOM BARS |
| WF5 | 12" | 5' - 2" | PER DETAIL | PER DETAIL |
| WF6 | 12" | 4' - 2" | PER DETAIL | PER DETAIL |

A1




DUMPSTER FOUNDATION PLAN

3/16" = 1'-0"

## PLAN NOTES - FOUNDATION

1. UNLESS NOTED OTHERWISE, ALL SLAB ON GRADE SHALL BE 4" THICK CONCRETE WITH WWF 6x6-W1.4xW1.4 OVER VAPOR BARRIER OVER 6" COMPACTED GRANULAR BASE. REFER TO TYPICAL DETAILS ON S 003 FOR ADDITIONAL REQUIREMENTS.
2. PROVIDE THICKENED SLAB BENEATH ALL INTERIOR NON-BEARING MASONRY WALLS. SEE TYPICAL THICKENED SLAB DETAIL. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF INTERIOR NON-BEARING MASONRY WALLS.
3. TOP OF SLAB-ON-GRADE ELEVATION = 100'-0", UNO.
4. TOP OF PIER AND FOUNDATION WALL ELEVATION = 99'-4", UNO.
5. TOP OF FOOTING ELEVATION = 96'-0" UNO. ALL EXTERIOR FOOTINGS TO EXTEND A MINIMUM OF 3'-6" BELOW FINISHED GRADE.
6. TOP OF FOOTING ELEVATION AT INTERIOR FOOTINGS = 99'-4", UNO.
7. TOP OF BRICK LEDGE ELEVATION = 99'-4", UNO.
8. REFER TO GENERAL NOTES FOR DESIGN SOIL BEARING CAPACITY.
9. REFER TO ARCHITECTURAL DRAWINGS FOR INTERIOR WALL DIMENSIONS.
10. VERIFY LOCATIONS OF COLUMNS, WALLS, OPENINGS, ETC. WITH ARCHITECTURAL DRAWINGS BEFORE PLACING FOUNDATIONS.
11. COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, AND UNDER FLOOR PIPES, CONDUITS, DRAINS, DEPRESSIONS, ETC.
12. PROVIDE FROST-FREE ENTRANCE APRON AT ALL EXTERIOR DOORS, REFER TO TYPICAL DETAIL.
13. REINFORCING SHOWN ON PLAN IS IN ADDITION TO REINFORCING SHOWN IN SECTIONS, DETAILS, AND SCHEDULES.

## KEYED NOTES - FOUNDATION

1 INDICATES 6" CONCRETE SLAB OVER 6" RIGID INSULATION OVER 6" CONCRETE SLAB OVER VAPOR BARRIER. REFER TO ARCHITECTURAL FOR ADDITIONAL INFORMATION.
2 REFER TO TYPICAL APRON/ENTRANCE DETAIL.
3 REFER TO CIVIL & LANDSCAPE FOR LOCATION OF DUMPSTER ENCLOSURE ON SITE.
4 ORIENT BASE PLATE WITH THE SHORTER SIDE LOCATED SUCH THAT THE GREATER CLEARANCE TO THE PIPE BOLLARD IS ACHIEVED.

## FOUNDATION PLAN LEGEND

| | |
|---|---|
| TOF | INDICATES TOP OF FOOTING |
| TOW | INDICATES TOP OF WALL |
| TOL | INDICATES TOP OF BRICK LEDGE |
| TOP | INDICATES TOP OF PIER |
| SF | STEPPED FOOTING. REFER TO TYPICAL DETAILS. CREATE EQUAL STEPS BETWEEN ADJACENT TOP OF FOOTING ELEVATIONS. |
| Fx/WFx | ISOLATED FOOTING OR WALL FOOTING DESIGNATION. REFER TO FOOTING SCHEDULES. |
| Px | CONCRETE PIER DESIGNATION. REFER TO TYPICAL PIER DETAILS. |

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OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
DUMPSTER FOUNDATION PLAN

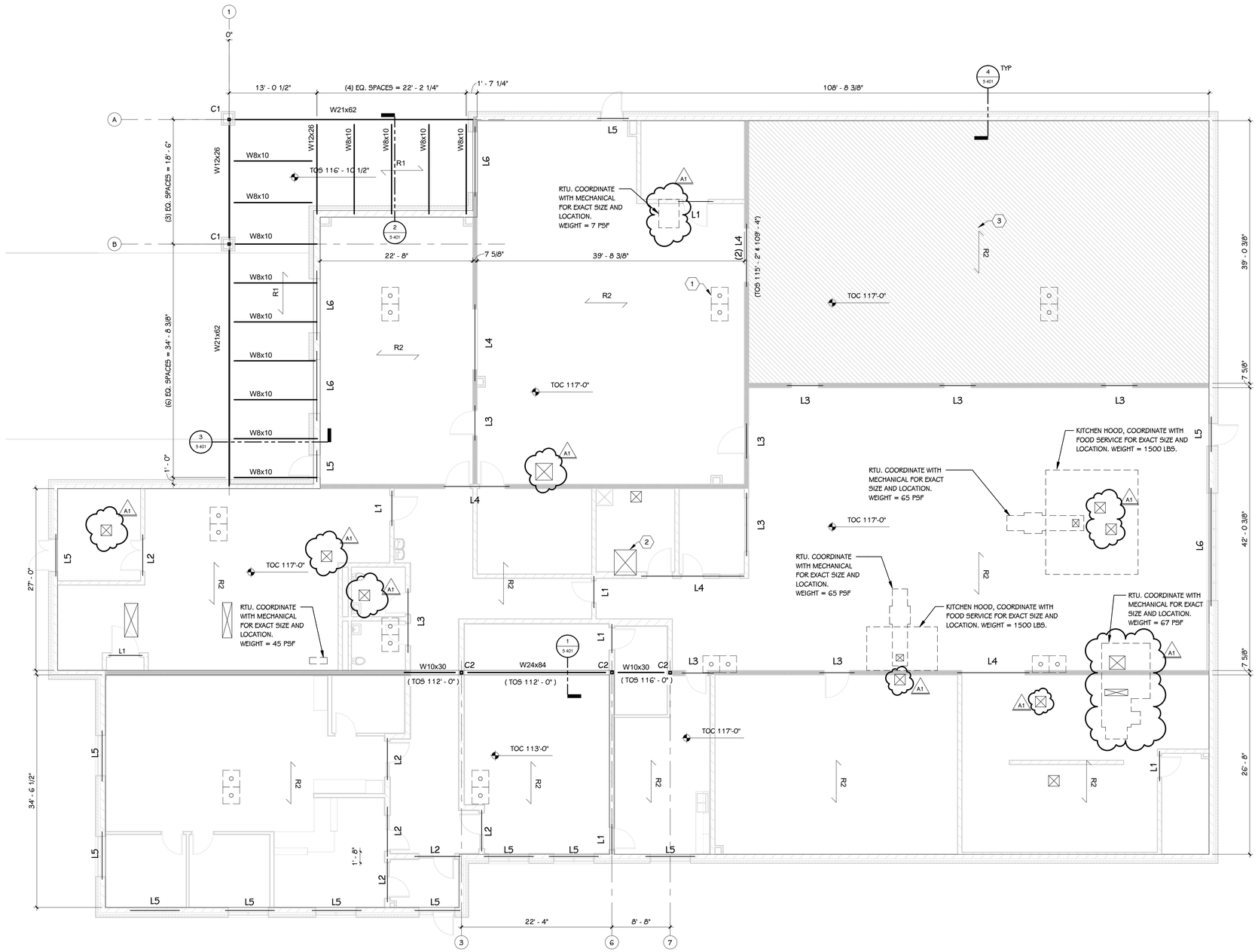
DATE
SEPTEMBER 20, 2024

A1
SHEET NUMBER
S 102
18-502.00

## COLUMN SCHEDULE

| MARK | SHAPE | BASE PLATE (TxWxL) | BASE PLATE TYPE | ANCHOR BOLTS |
|---|---|---|---|---|
| C1 | HSS4x4x1/2 | 3/4"x8"x10" | A | (4) 3/4" DIA. W/ 9" EMBED |
| C2 | HSS4-1/2x4-1/2x1/2 | 3/4"x10"x10" | B | (4) 3/4" DIA. W/ 9" EMBED |
| C3 | HSS6x6x3/8 | 3/4"x10"x12" | A | (4) 3/4" DIA. W/ 9" EMBED |

A1




## ROOF FRAMING PLAN
1/8" = 1'-0"

## PLAN NOTES - ROOF

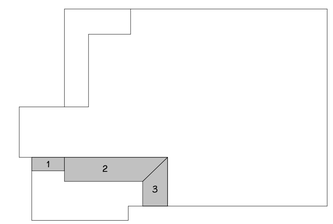
1. REFER TO PLAN FOR TOS & TOC ELEVATIONS.
2. REINFORCED MASONRY DESIGNATED THUS: MW$_R$. REFER TO TYPICAL DETAILS FOR MASONRY WALL CONSTRUCTION. MASONRY WALLS SHALL BE MW$_1$, UNO.
3. ALL MASONRY WALLS TO EXTEND TO UNDERSIDE OF ROOF DECK, UNO. REFER TO TYPICAL DETAILS.
4. REFER TO ARCHITECTURAL DRAWINGS FOR INTERIOR WALL DIMENSIONS.
5. ALL OPENINGS IN MASONRY WALLS WIDER THAN 8" REQUIRE LINTELS. FOR LINTELS NOT SHOWN ON PLANS, REFER TO LINTEL SCHEDULE FOR SIZE, COORDINATE LOCATIONS AND OPENING WIDTHS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.

## KEYED NOTES - FRAMING

1 ROOF OPENING FRAME FOR ROOF DRAIN OR OTHER OPENING IN ROOF DECK. REFER TO TYPICAL DETAIL. COORDINATE WITH MECHANICAL CONTRACTOR.
2 ROOF ACCESS HATCH, COORDINATE WITH ARCHITECTURAL.
3 FREEZER / COOLER, REFER TO S 001 FOR LOADING.

## FRAMING PLAN LEGEND

| | |
|---|---|
| CX | COLUMN TAG - SEE COLUMN SCHEDULE. TAG APPEARS ON THE LEVEL CORRESPONDING TO THE TOP OF THE COLUMN. |
| RX | SPAN DIRECTION FOR ROOF OR FLOOR DECK. REFER TO S 001 FOR ADDITIONAL INFORMATION. |
| LX or MLX | INDICATES LINTEL TYPE. SEE LINTEL SCHEDULE FOR SIZE OF LINTEL. 'L' PREFIX INDICATES STEEL LINTEL. 'ML' PREFIX INDICATES MASONRY LINTEL. |
| | SPOT ELEVATION. |
| TOS | INDICATES TOP OF STEEL. |
| TOC | INDICATES TOP OF PRECAST CONCRETE HOLLOWCORE PLANK. |
| R1 | INDICATES 1-1/2" x 18 GAGE DECK. |
| R2 | INDICATES 12" PRECAST CONCRETE HOLLOWCORE PLANK. |
| | INDICATES FRAMED OPENING. COORDINATE SIZE AND LOCATION WITH MECHANICAL AND ARCHITECTURAL REQUIREMENTS. |
| | SHADED WALL REGION INDICATES BEARING WALL. |
| | INDICATES ROOF DRAIN. COORDINATE SIZE AND LOCATION WITH MECHANICAL AND ARCHITECTURAL REQUIREMENTS. |

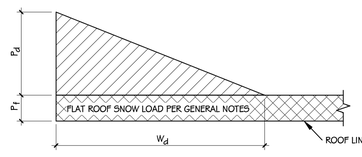



## DRIFTED SNOW PLAN
1" = 40'-0"

## SNOW DRIFT SCHEDULE

| DRIFT | $W_d$ | $P_d$ | NOTES |
|---|---|---|---|
| 1 | 7' - 7" | 35 PSF | - |
| 2 | 13' - 6" | 62 PSF | - |
| 3 | 13' - 11" | 64 PSF | - |

NOTES:
1. SNOW DRIFT VALUES INDICATED ARE IN ADDITION TO FLAT ROOF SNOW LOAD.
2. ONLY DRIFTS ON NEW CONSTRUCTION OR DRIFTS ON EXISTING CONSTRUCTION CAUSED OR IMPACTED BY NEW CONSTRUCTION ARE INDICATED IN SCHEDULE.
3. AT LOCATIONS WHERE SNOW DRIFTS OVERLAP THE HIGHER VALUE OF THE INTERSECTION DRIFTS SHALL BE TAKEN.

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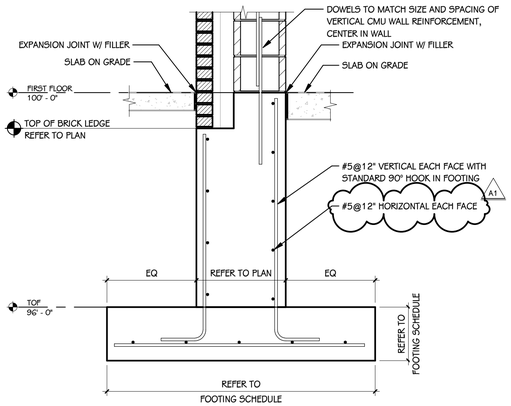
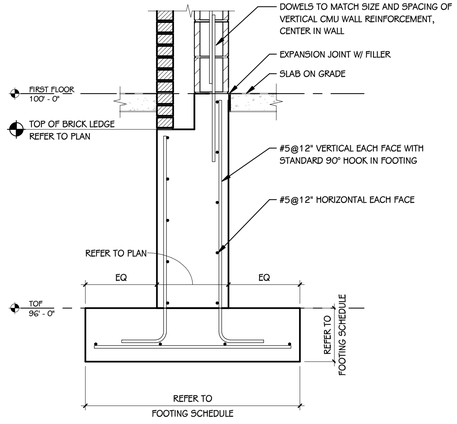
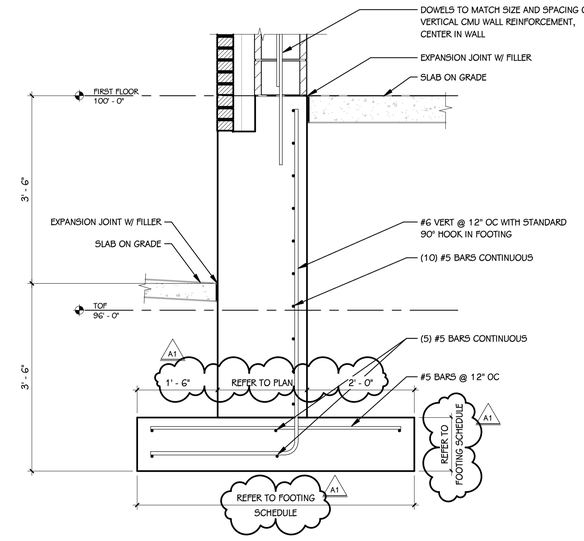


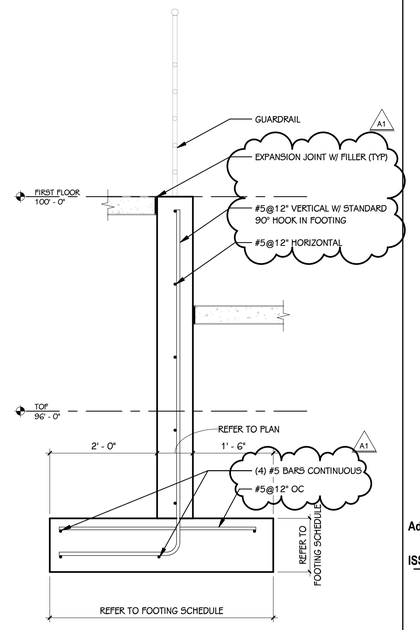

1 / S 301 SECTION
3/4" = 1'-0"



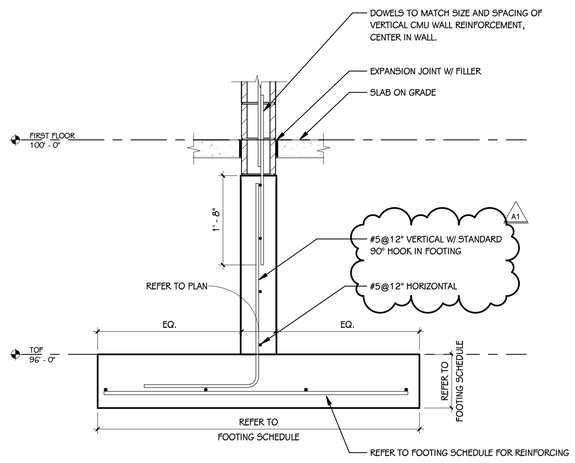

2 / S 301 SECTION
3/4" = 1'-0"



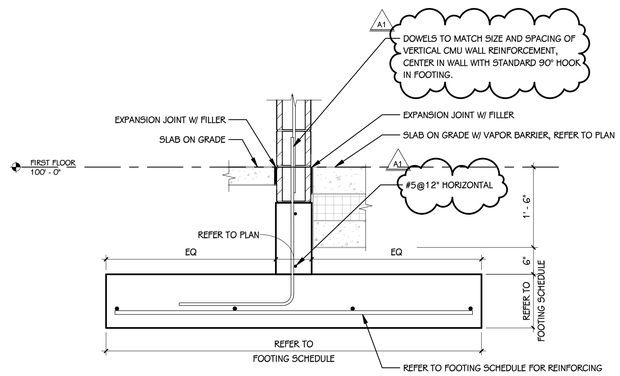

3 / S 301 SECTION
3/4" = 1'-0"



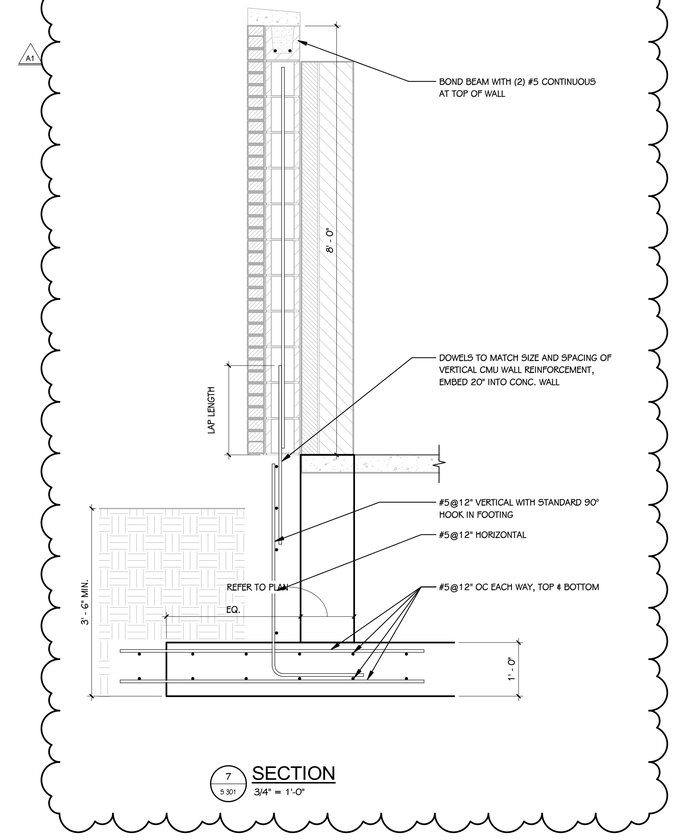

4 / S 301 SECTION
3/4" = 1'-0"




5 / S 301 SECTION
3/4" = 1'-0"




6 / S 301 SECTION
3/4" = 1'-0"




7 / S 301 SECTION
3/4" = 1'-0"

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PROJECT TITLE
DISTRICT KITCHEN

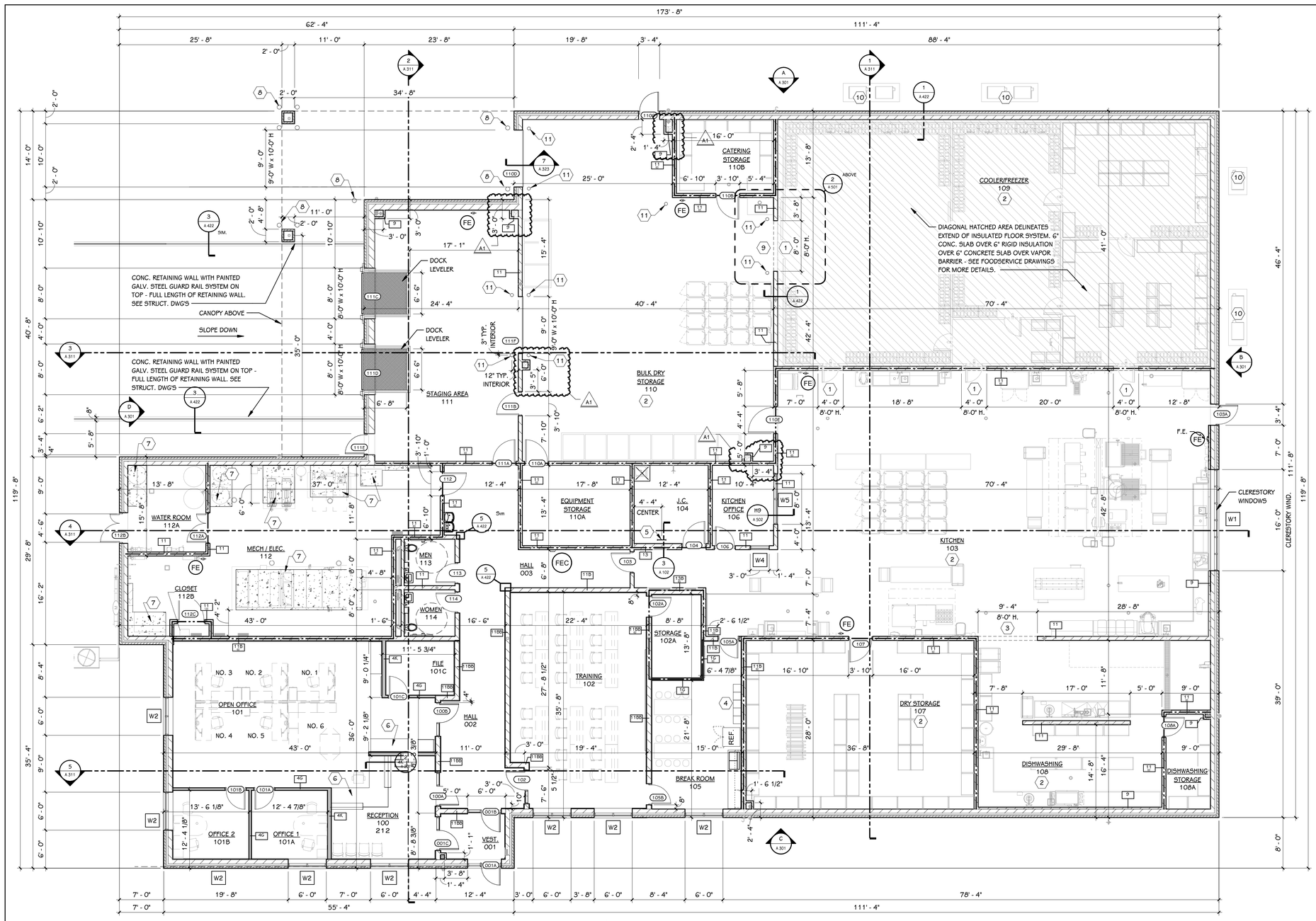
OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
FOUNDATION DETAILS

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
S 301
18-502.00




## FIRST FLOOR PLAN

1/8" = 1'-0"

## GENERAL NOTES

1. REFER TO CODE COMPLIANCE PLAN FOR WALL RATING LINES.
2. REFER TO FLOOR FINISH PLANS FOR INTERIOR ELEVATION CALLOUTS.
3. REFER TO SHEET A 501 AND A 502 FOR WALL AND CEILING ACCESS PANEL INFORMATION.

## KEYED NOTES - NEW CONSTRUCTION

1. DOOR AS PART OF FREEZER UNIT, NOT LISTED ON DOOR SCHEDULE. DIMENSIONS INDICATE WALL OPENING IN CMU BLOCK WALL.
2. FURNISHINGS AND EQUIPMENT - REFER TO FOOD SERVICE DRAWINGS.
3. DIMENSIONS INDICATE WALL OPENING IN CMU BLOCK WALL.
4. DOUBLE TIER LOCKERS: 15"x15"x60". TOTAL COUNT = 10
5. PAINTED STEEL ROOF LADDER
6. CASEWORK AND COUNTERTOP - REFER TO INTERIORS
7. CONCRETE PAD - COORDINATE WITH MECHANICAL DRAWINGS FOR SIZE AND LOCATION AND WITH STRUCTURAL DRAWINGS FOR DETAILS
8. PRIME AND PAINT 6" DIA. GALV. STEEL BOLLARDS - EXTERIOR
9. ACCESS PANEL CENTERED ABOVE OPENING, REFER TO DETAIL AND SECTION ON A502
10. CONCRETE PAD - FOR FOOD SERVICE EQUIPMENT - REFER TO FOOD SERVICE
11. PRIME AND PAINT 6" DIA. GALV. STEEL BOLLARDS - INTERIOR

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FIRST FLOOR PLAN

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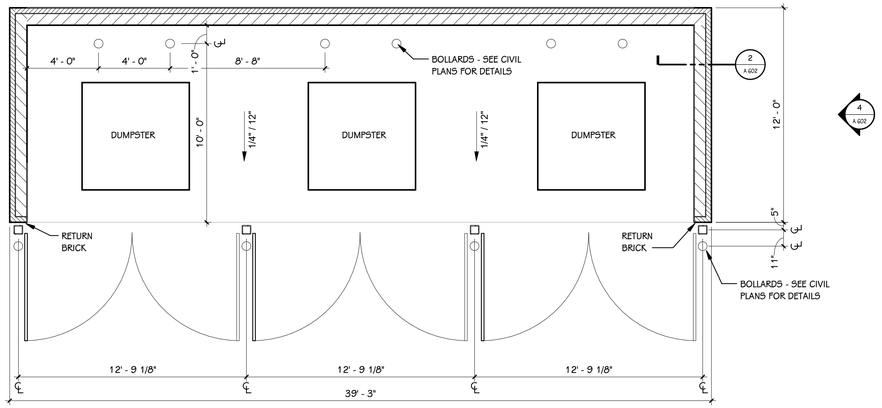
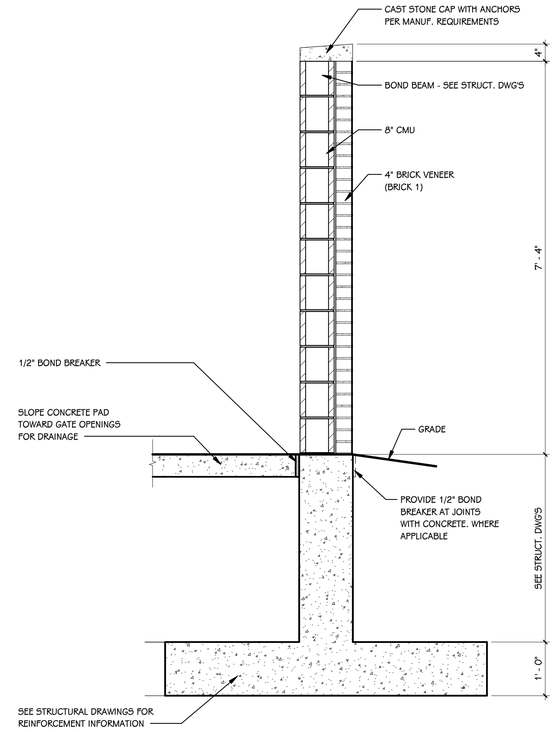
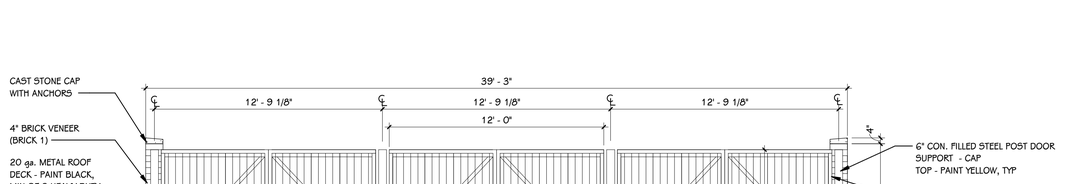



1 A 602 **FIRST FLOOR PLAN**
1/4" = 1'-0"

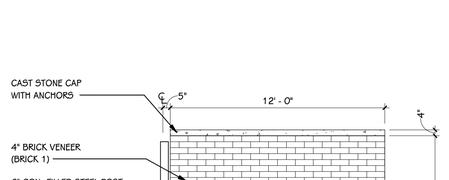
NOTE: REFER TO CIVIL DRAWINGS FOR DUMPSTER ENCLOSURE LOCATION




2 A 602 **WALL SECTION - DUMPSTER ENCLOSURE**
3/4" = 1'-0"




3 A 602 **ELEVATION - DUMPSTER ENCLOSURE GATE**
1/4" = 1'-0"




4 A 602 **ELEVATION - DUMPSTER ENCLOSURE**
1/4" = 1'-0"

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DUMPSTER ENCLOSURE

SHEET NUMBER
A 602
18-502.00

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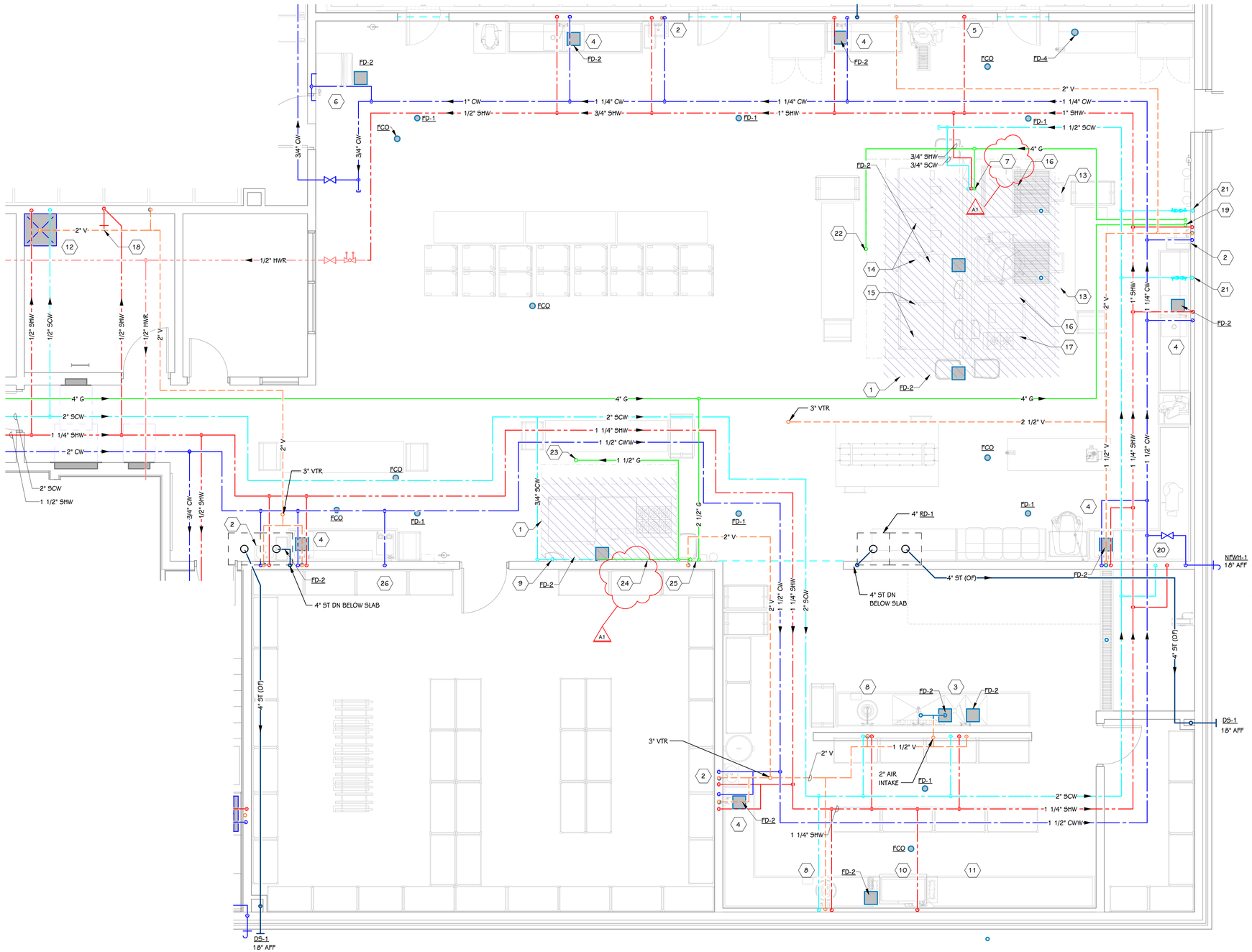


ENLARGED KITCHEN PLUMBING PLAN

1/4" = 1'-0"

## KEYED NOTES - ENLARGED PLUMBING

1 CLEARANCE REQUIRED FOR KITCHEN HOOD EQUIPMENT.

2 EBO (HAND SINK); 1/2" CW & SHW, 1-1/2" SAN DN; 1-1/4" V UP. TRANSITION TO 3" SAN AT SLAB.

3 EBO (THREE-COMPARTMENT SINK); 3/4" CW & SHW - DISTRIBUTE TO EACH FAUCET, REFER TO THREE-COMPARTMENT SINK WASTE PIPING - KITCHEN DETAIL FOR SAN.

4 EBO (PREP, WORK, OR DISH TABLE AS INDICATED); 1/2" CW & SHW DN. DRAIN TO FLOOR SINK.

5 EBO (POT FILLER); 1/2" SHW DN, 3" SAN DN TO FLOOR TROUGH.

6 EBO (ICE MAKER & FILTER); 1/2" CW DN - ROUTE THRU FILTER THEN ICE MAKER. DRAIN TO FLOOR SINK.

7 3/4" SCW & SHW, 2-1/2" G DN TO UTILITY DISTRIBUTION SYSTEM (UDS).

8 EBO (DISPOSAL); 3/4" SCW, 1/2" SHW, 2" SAN DN, 1-1/2" V UP. TRANSITION TO 3" SAN AT SLAB.

9 EBO (COMBI OVEN - DOUBLE DECK) 3/4" SCW DN ALONG WALL - DISTRIBUTE 1/2" SCW THRU FILTER TO OVEN, 1/2" SCW TO DRAIN WATER TEMPERING KIT, 3/4" G DN. DRAIN TO FLOOR SINK.

10 EBO (DISHWASHER); 1/2" SHW FROM BOOSTER HEATER. DRAIN TO FLOOR SINK.

11 EBO (BOOSTER HEATER); 3/4" SHW, 3/4" G DN; ROUTE TO DISHWASHER.

12 EBO (MOP BASIN); 1/2" SCW & SHW, 2" SAN DN. 1-1/2" V UP.

13 EBO (TEMPERED FLOOR TROUGH); 1" SCW, 3" SAN (GREASE) DN.

14 EBO (COMBI OVEN - ROLL IN); SCW LINE FROM UDS - ROUTE THRU RO SYSTEM TO OVEN, G LINE FROM UDS, DRAIN TO FLOOR SINK.

15 EBO (COMBI OVEN - DOUBLE DECK); SCW LINE FROM UDS - ROUTE THRU RO SYSTEM TO OVEN, G LINE FROM UDS, DRAIN TO FLOOR SINK.

16 EBO (TILT SKILLET OR KETTLE AS INDICATED); SCW, SHW, & G LINES FROM UDS, DRAIN TO TEMPERED FLOOR TROUGH.

17 EBO (STEAMER); SCW LINES FROM UDS - ROUTE THRU RO SYSTEM TO STEAMER, G LINE FROM UDS, DRAIN TO TEMPERED FLOOR TROUGH.

18 HOSE BIBB; 1/2" SHW DN. PROVIDE WITH BACKFLOW PREVENTOR FOR SOAP DISPENSER.

19 CONNECT 4" G TO GAS SHUTOFF VALVE - PROVIDED BY FSEC.

20 EBO (HOSE REEL); 1/2" SCW & SHW DN.

21 1" SCW DN BELOW SLAB. PROVIDE BACKFLOW PREVENTOR ABOVE CEILING. REFER TO FSE PLANS FOR DETAIL.

22 2-1/2" G UP TO ROOFTOP MAU.

23 1-1/2" G UP TO ROOFTOP MAU.

24 RUN 2" G ALONG WALL; DISTRIBUTE TO FSE. REFER TO FSE PLANS FOR CONNECTION SIZES.

25 CONNECT 2-1/2" G TO GAS SHUTOFF VALVE - PROVIDED BY FSEC.

26 EBO (AIRPOT COFFEE BREWER); 1/2" CW DN. ROUTE THRU FILTER THEN TO BREWER.

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| ISSUED FOR | DATE |

PROJECT TITLE
DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

SHEET TITLE
ENLARGED PLUMBING PLANS

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
P 301
18-502.00

## KEYED NOTES - ENLARGED PLUMBING

1 CLEARANCE REQUIRED FOR KITCHEN HOOD EQUIPMENT.

2 EBO (HAND SINK); 1/2" CW & SHW, 1-1/2" SAN DN; 1-1/4" V UP. TRANSITION TO 3" SAN AT SLAB.

3 EBO (THREE-COMPARTMENT SINK); 3/4" CW & SHW - DISTRIBUTE TO EACH FAUCET, REFER TO THREE-COMPARTMENT SINK WASTE PIPING - KITCHEN DETAIL FOR SAN.

4 EBO (PREP, WORK, OR DISH TABLE AS INDICATED); 1/2" CW & SHW DN. DRAIN TO FLOOR SINK.

5 EBO (POT FILLER); 1/2" SHW DN, 3" SAN DN TO FLOOR TROUGH.

6 EBO (ICE MAKER & FILTER); 1/2" CW DN - ROUTE THRU FILTER THEN ICE MAKER. DRAIN TO FLOOR SINK.

7 3/4" SCW & SHW, 2-1/2" G DN TO UTILITY DISTRIBUTION SYSTEM (UDS).

8 EBO (DISPOSAL); 3/4" SCW, 1/2" SHW, 2" SAN DN; 1-1/2" V UP. TRANSITION TO 3" SAN AT SLAB.

9 EBO (COMBI OVEN - DOUBLE DECK) 3/4" SCW DN ALONG WALL - DISTRIBUTE 1/2" SCW THRU FILTER TO OVEN, 1/2" SCW TO DRAIN WATER TEMPERING KIT, 3/4" G DN. DRAIN TO FLOOR SINK.

10 EBO (DISHWASHER); 1/2" SHW FROM BOOSTER HEATER. DRAIN TO FLOOR SINK.

11 EBO (BOOSTER HEATER); 3/4" SHW, 3/4" G DN; ROUTE TO DISHWASHER.

12 EBO (MOP BASIN); 1/2" SCW & SHW, 2" SAN DN. 1-1/2" V UP.

13 EBO (TEMPERED FLOOR TROUGH); 1" SCW, 3" SAN (GREASE) DN.

14 EBO (COMBI OVEN - ROLL IN); SCW LINE FROM UDS - ROUTE THRU RO SYSTEM TO OVEN, G LINE FROM UDS, DRAIN TO FLOOR SINK.

15 EBO (COMBI OVEN - DOUBLE DECK); SCW LINE FROM UDS - ROUTE THRU RO SYSTEM TO OVEN, G LINE FROM UDS, DRAIN TO FLOOR SINK.

16 EBO (TILT SKILLET OR KETTLE AS INDICATED); SCW, SHW, & G LINES FROM UDS, DRAIN TO TEMPERED FLOOR TROUGH.

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21 1" SCW DN BELOW SLAB. PROVIDE BACKFLOW PREVENTOR ABOVE CEILING. REFER TO FSE PLANS FOR DETAIL.

22 2-1/2" G UP TO ROOFTOP MAU.

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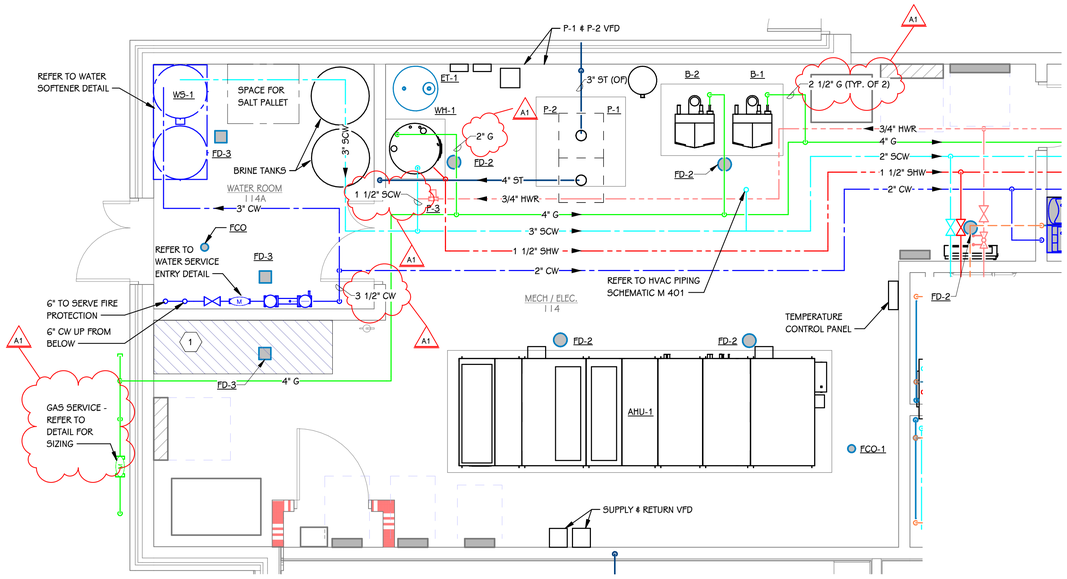
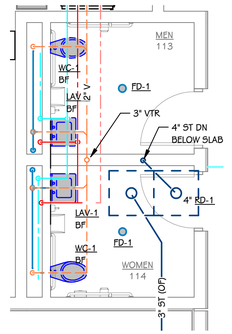



ENLARGED MECHANICAL ROOM PLAN
1/4" = 1'-0"




ENLARGED RESTROOM PLAN
1/4" = 1'-0"

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DISTRICT KITCHEN

OWNER
KALAMAZOO PUBLIC SCHOOLS

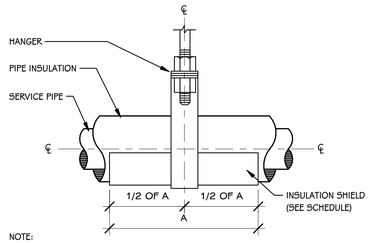
Kalamazoo, Michigan

SHEET TITLE
ENLARGED PLUMBING PLANS

DATE
SEPTEMBER 20, 2024

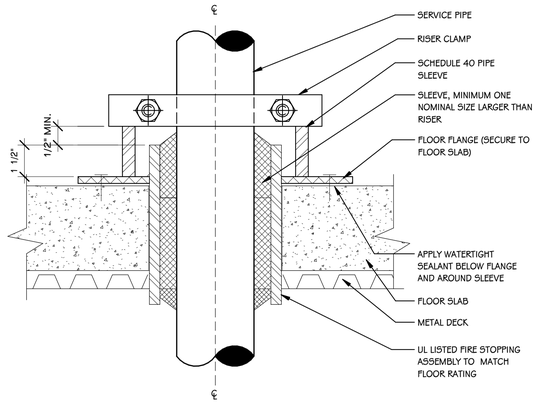
SHEET NUMBER
P 302
18-502.00

| INSULATION SHIELD SCHEDULE | | | |
|---|---|---|---|
| PIPE SIZE | DIMENSION "A" | GAUGE OF SHIELD | SHIELD THICKNESS |
| 1/2" TO 4" | 12" | 18 | 0.0480 |
| 5" TO 6" | 18" | 16 | 0.0600 |
| ABOVE 6" | 24" | 14 | 0.0750 |

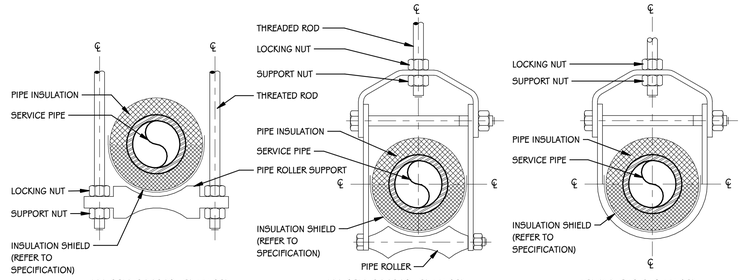



NOTE:
1. SEE SPECIFICATION FOR FLANGER SIZES

## PIPE HANGER / SHIELD DETAIL
SCALE: NONE

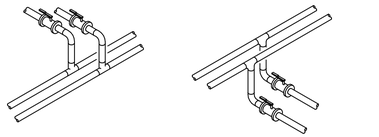



## PIPE PENETRATION / PIPE RISER SUPPORT DETAIL A
SCALE: NONE




NOTE:
1. SEE SPECIFICATION FOR HANGER SIZES (TYP.)

## PIPE HANGER SUPPORT DETAIL A
SCALE: NONE



BRANCH CONNECTION OFF TOP

APPLIES TO THE FOLLOWING SYSTEMS:
DOMESTIC WATER
NATURAL GAS
STEAM / CONDENSATE

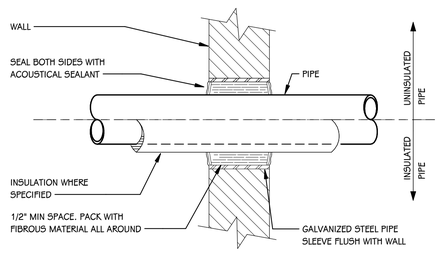


BRANCH CONNECTION OFF BOTTOM

APPLIES TO THE FOLLOWING SYSTEMS:
HEATING HOT WATER

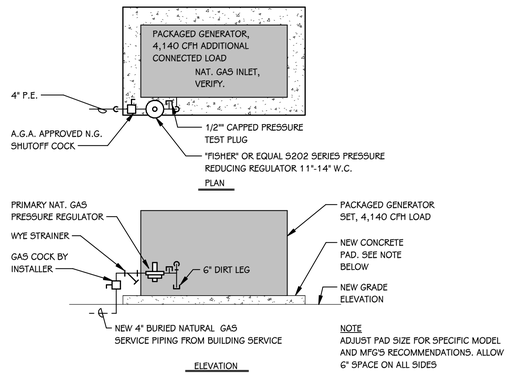
NOTE: BOTTOM AS INDICATED OR SIDE CONNECTION IS ACCEPTABLE. CONNECTION TO THE TOP OF THE MAINS IS NOT ACCEPTABLE.

## BRANCH TAKE-OFF PIPING DETAIL
SCALE: NONE




NOTE
1. WHERE PIPING IS EXPOSED TO VIEW PROVIDE WITH ESCUTCHEON.
2. FOR RATED WALLS REFER TO FIRE STOP SPECIFICATIONS.

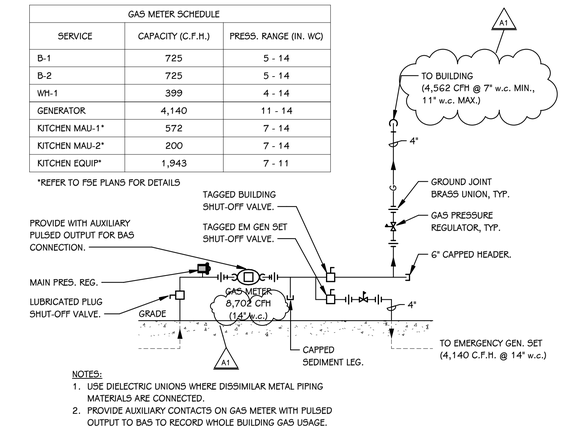
## PENETRATION NOT RATED DETAIL
SCALE: NONE




## TYPICAL GENERATOR FUEL PIPING
SCALE: NONE

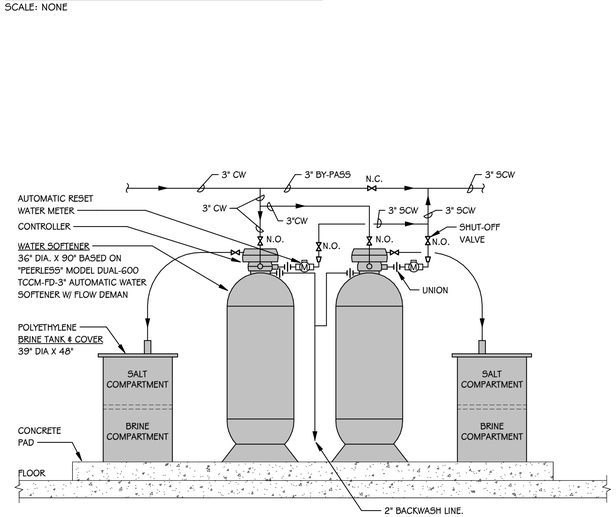
| GAS METER SCHEDULE | | |
|---|---|---|
| SERVICE | CAPACITY (C.F.H.) | PRESS. RANGE (IN. WC) |
| B-1 | 725 | 5 - 14 |
| B-2 | 725 | 5 - 14 |
| WH-1 | 399 | 4 - 14 |
| GENERATOR | 4,140 | 11 - 14 |
| KITCHEN MAU-1* | 572 | 7 - 14 |
| KITCHEN MAU-2* | 200 | 7 - 14 |
| KITCHEN EQUIP* | 1,943 | 7 - 11 |

*REFER TO FSE PLANS FOR DETAILS

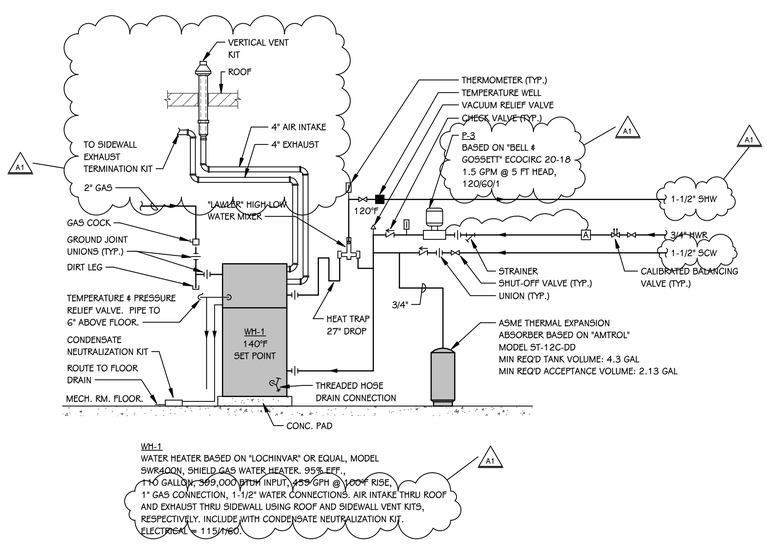



NOTES:
1. USE DIELECTRIC UNIONS WHERE DISSIMILAR METAL PIPING MATERIALS ARE CONNECTED.
2. PROVIDE AUXILIARY CONTACTS ON GAS METER WITH PULSED OUTPUT TO BAS TO RECORD WHOLE BUILDING GAS USAGE.

## GAS SERVICE PIPING DETAIL
SCALE: NONE

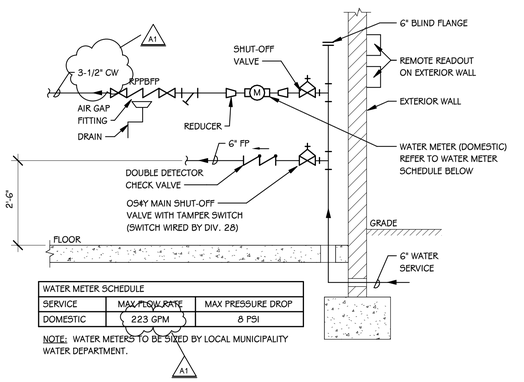



## WATER SOFTENER DETAIL - DUPLEX
SCALE: NONE




WH-1
WATER HEATER BASED ON "LOCHINVAR" OR EQUAL, MODEL SWR400N, SHIELD GAS WATER HEATER. 95% EFF., 140 GALLON, 399,000 BTUH INPUT, 353 GPH @ 100°F RISE, 1" GAS CONNECTION, 1-1/2" WATER CONNECTIONS. AIR INTAKE THRU ROOF AND EXHAUST THRU SIDEWALL USING ROOF AND SIDEWALL VENT KITS, RESPECTIVELY. INCLUDE WITH CONDENSATE NEUTRALIZATION KIT. ELECTRICAL = 115/1/60

## WATER HEATER DETAIL - DOMESTIC
SCALE: NONE




| WATER METER SCHEDULE | | |
|---|---|---|
| SERVICE | MAX FLOW RATE | MAX PRESSURE DROP |
| DOMESTIC | 223 GPM | 8 PSI |

NOTE: WATER METERS TO BE SIZED BY LOCAL MUNICIPALITY WATER DEPARTMENT.

## WATER SERVICE DETAIL
SCALE: NONE

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DISTRICT KITCHEN

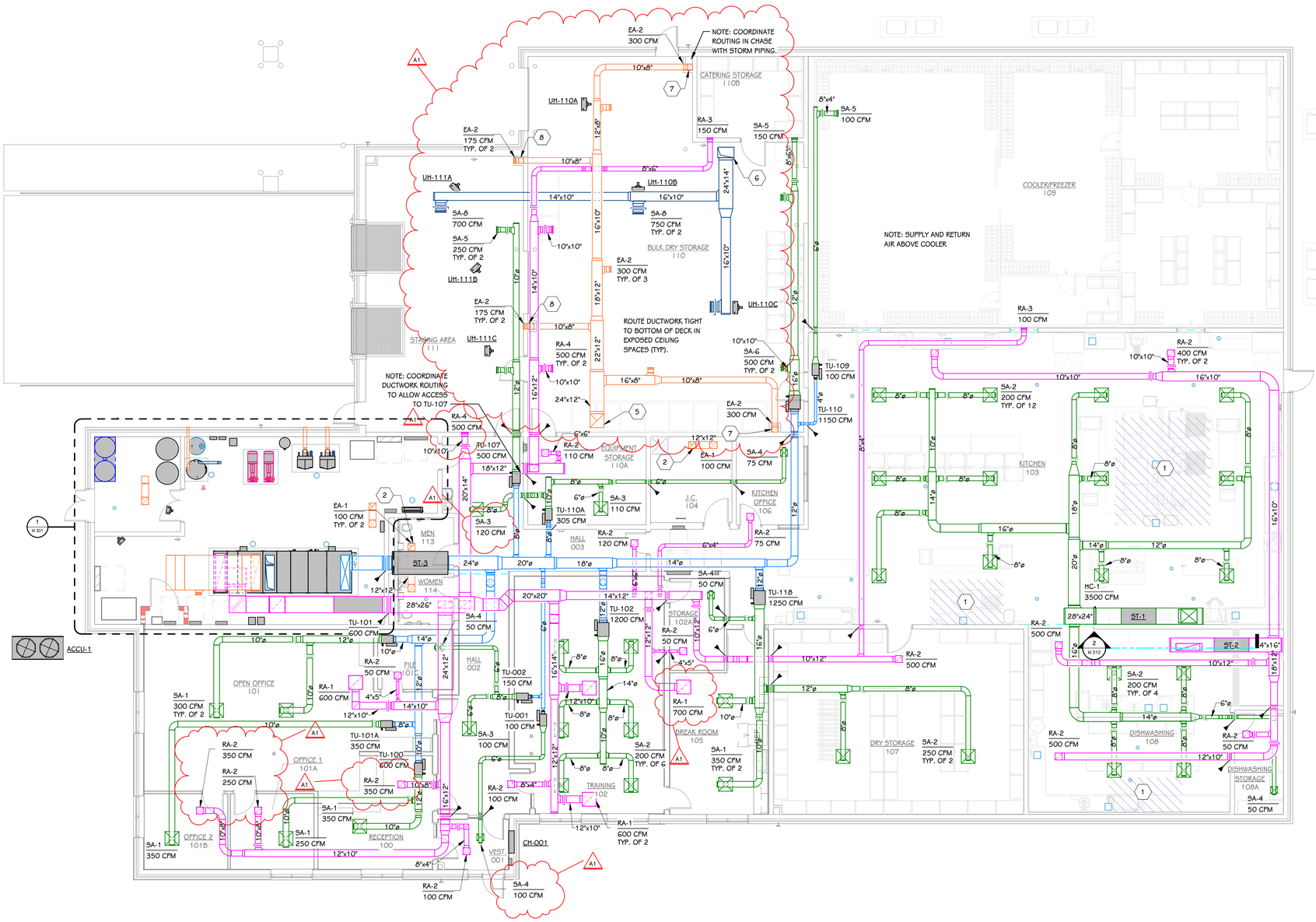
OWNER
KALAMAZOO PUBLIC SCHOOLS

Kalamazoo, Michigan

SHEET TITLE
PLUMBING DETAILS

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
P 501
18-502.00




FIRST FLOOR SHEET METAL PLAN

1/8" = 1'-0"

**KEYED NOTES - MECHANICAL**

1 CLEARANCE REQUIRED FOR KITCHEN HOOD EQUIPMENT.

2 EXHAUST AIR DUCT UP TO ROOFTOP EXHAUST FAN. REFER TO MECHANICAL ROOF PLAN.

3 4" WATER HEATER COMBUSTION AIR INTAKE. MAINTAIN 10'-0" CLEARANCE FROM EXHAUST AIR.

4 4" BOILER COMBUSTION AIR INTAKE. MAINTAIN 10'-0" CLEARANCE FROM EXHAUST.

5 24"X24" EXHAUST AIR DUCT UP TO EF-5. REFER TO MECHANICAL ROOF PLAN.

6 18"X28" OUTSIDE AIR DUCT DOWN FROM IH-2. REFER TO MECHANICAL ROOF PLAN.

7 ROUTE EXHAUST DUCT DN CHASE. EXHAUST LOW IN BULK DRY STORAGE.

8 ROUTE EXHAUST DUCT DN CHASE. EXHAUST HIGH AND LOW IN STAGING AREA.

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DISTRICT KITCHEN

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Kalamazoo, Michigan

SHEET TITLE
FIRST FLOOR SHEET METAL PLAN

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
M 101

18-502.00

## KEYED NOTES - MECHANICAL

1 CLEARANCE REQUIRED FOR KITCHEN HOOD EQUIPMENT.

2 EXHAUST AIR DUCT UP TO ROOFTOP EXHAUST FAN. REFER TO MECHANICAL ROOF PLAN.

3 4" WATER HEATER COMBUSTION AIR INTAKE. MAINTAIN 10'-0" CLEARANCE FROM EXHAUST AIR.

4 4" BOILER COMBUSTION AIR INTAKE. MAINTAIN 10'-0" CLEARANCE FROM EXHAUST.

5 24"X24" EXHAUST AIR DUCT UP TO EF-5. REFER TO MECHANICAL ROOF PLAN.

6 18"X28" OUTSIDE AIR DUCT DOWN FROM IH-2. REFER TO MECHANICAL ROOF PLAN.

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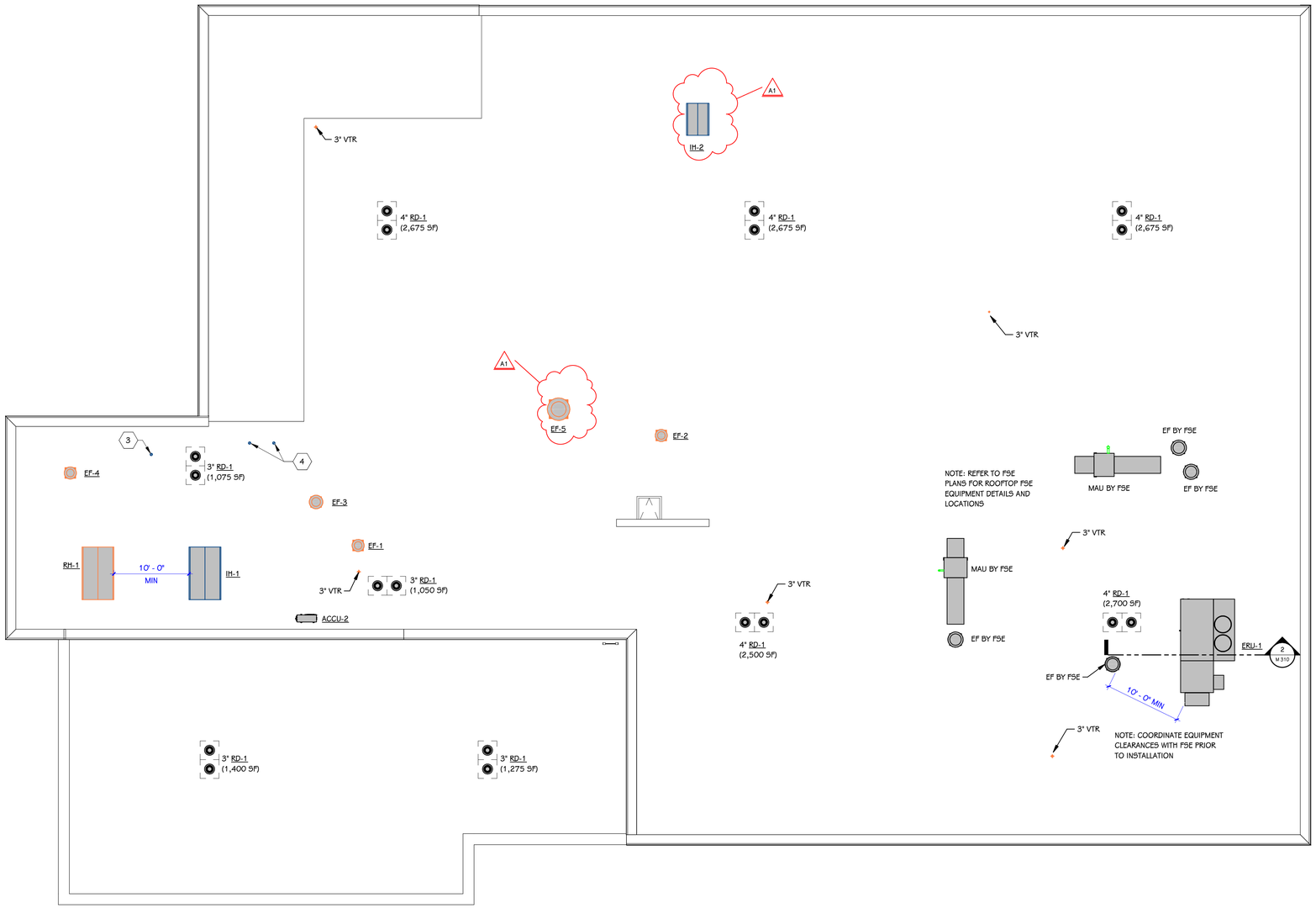
8 ROUTE EXHAUST DUCT DN CHASE. EXHAUST HIGH AND LOW IN STAGING AREA.




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

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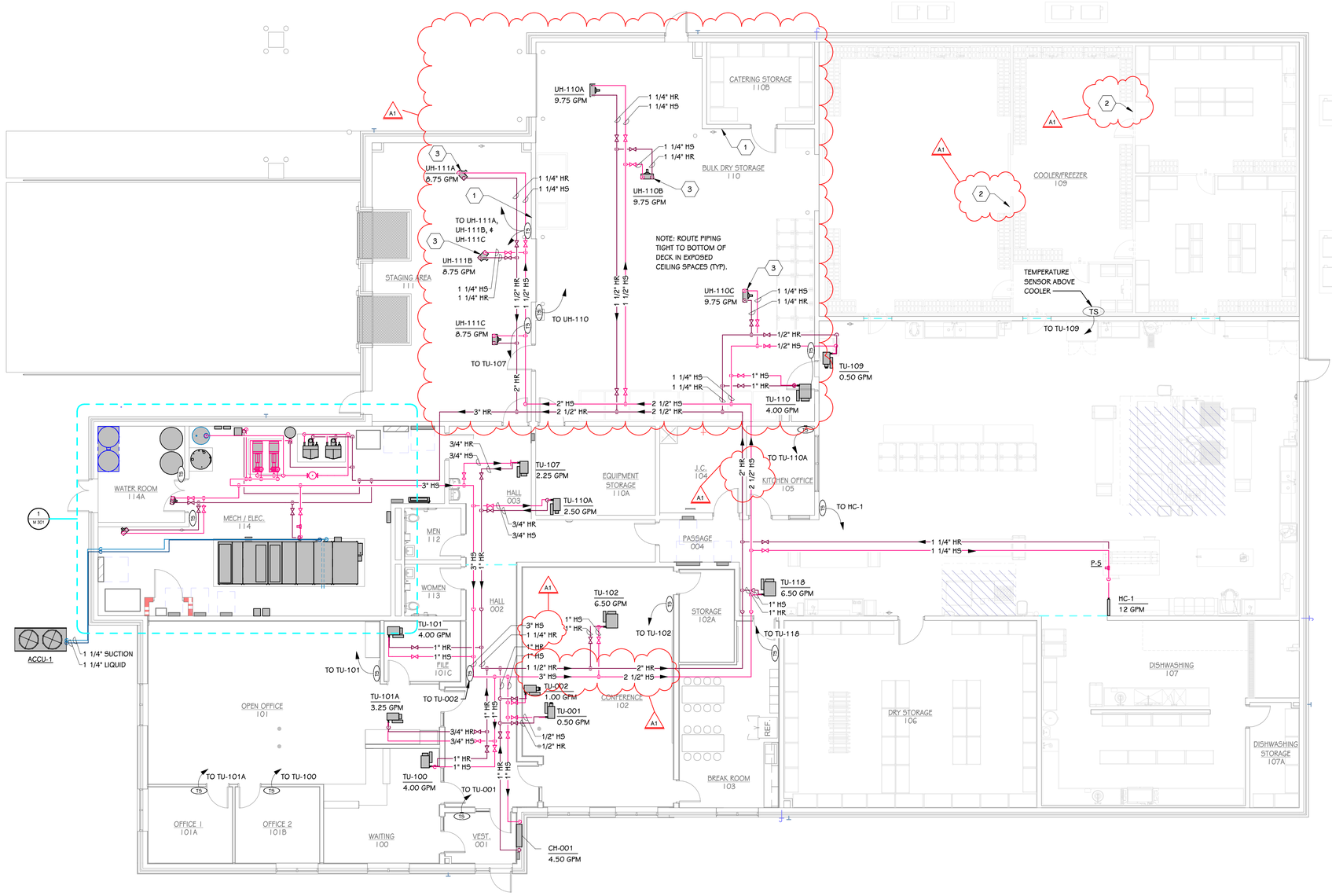
Kalamazoo, Michigan

SHEET TITLE
MECHANICAL ROOF PLAN

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
M 150
18-502.00




FIRST FLOOR HVAC PIPING PLAN
1/8" = 1'-0"

**KEYED NOTES - HVAC PIPING**

1 CO AND NO2 MONITORS SHALL ACTIVATE THE EXHAUST SYSTEM. MONITORS BASED ON AGS CO/S-P5A & NO2/S-P5A. MOUNTING HEIGHT PER MANUFACTURER'S RECOMMENDATIONS.

2 CO AND NO2 MONITORS SHALL MONITOR AIR QUALITY ONLY. MONITORS BASED ON AGS CO/S-P5A & NO2/S-P5A. MOUNTING HEIGHT PER MANUFACTURER'S RECOMMENDATION.

3 INSTALL UNIT HEATER BELOW OA SUPPLY DUCT.

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Kalamazoo, Michigan

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FIRST FLOOR HVAC PIPING PLAN

DATE
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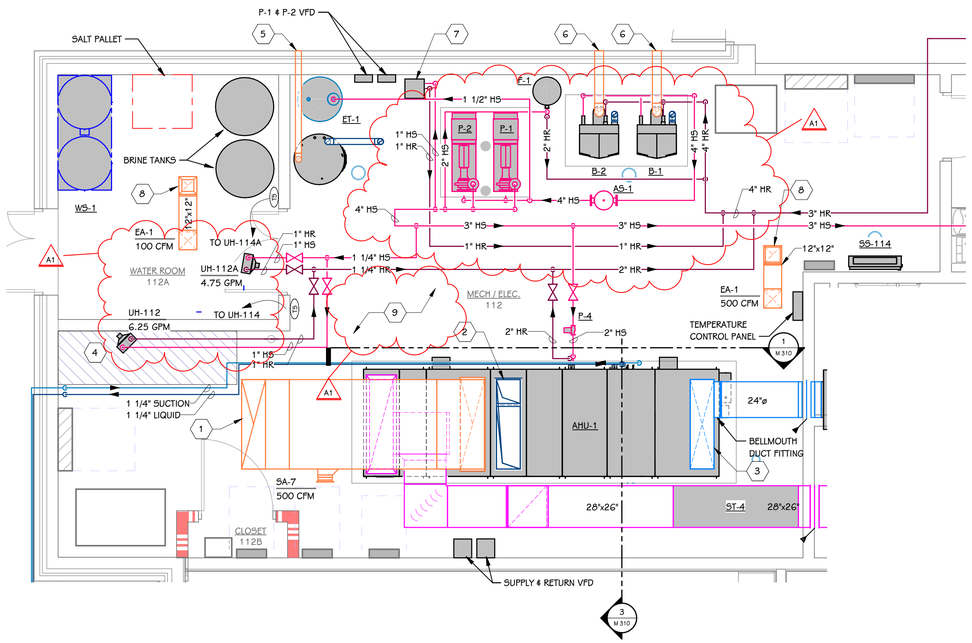
SHEET NUMBER
M 201
18-502.00




I / M 301 ENLARGED MECHANICAL ROOM PLAN
1/4" = 1'-0"

**KEYED NOTES - ENLARGED MECHANICAL**

1. RELIEF AIR DUCT DN FROM RELIEF AIR HOOD ON ROOF.
2. OUTSIDE AIR DUCT DN FROM INTAKE HOOD ON ROOF. OA DUCT SPLIT IN TWO FOR MINIMUM OA AND ECONOMIZING MODES.
3. MEDIUM PRESSURE SUPPLY AIR DUCT UP FROM AIR HANDLER.
4. SPACE RESERVED FOR FIRE PROTECTION EQUIPMENT
5. 4" WATER HEATER EXHAUST VENT. PROVIDE WITH SIDEWALL VENT KIT.
6. 6" BOILER EXHAUST VENT. PROVIDE WITH SIDEWALL VENT KIT.
7. BYPASS POT FILLER WITH FLOOR STAND. REFER TO HEATING WATER PIPING SCHEMATIC.
8. EXHAUST AIR DUCT UP TO ROOFTOP EXHAUST FAN. REFER TO MECHANICAL ROOF PLAN.
9. ROUTE PIPING TIGHT TO BOTTOM OF DECK IN EXPOSED CEILING SPACES (TYP).

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Kalamazoo, Michigan

SHEET TITLE
ENLARGED MECHANICAL PLANS

DATE
SEPTEMBER 20, 2024

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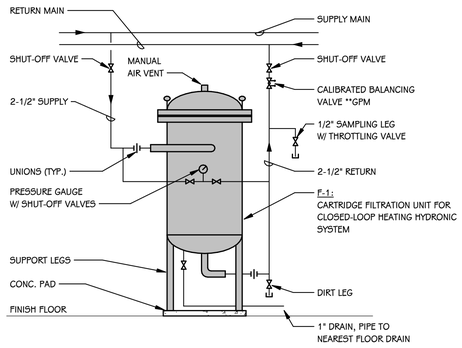
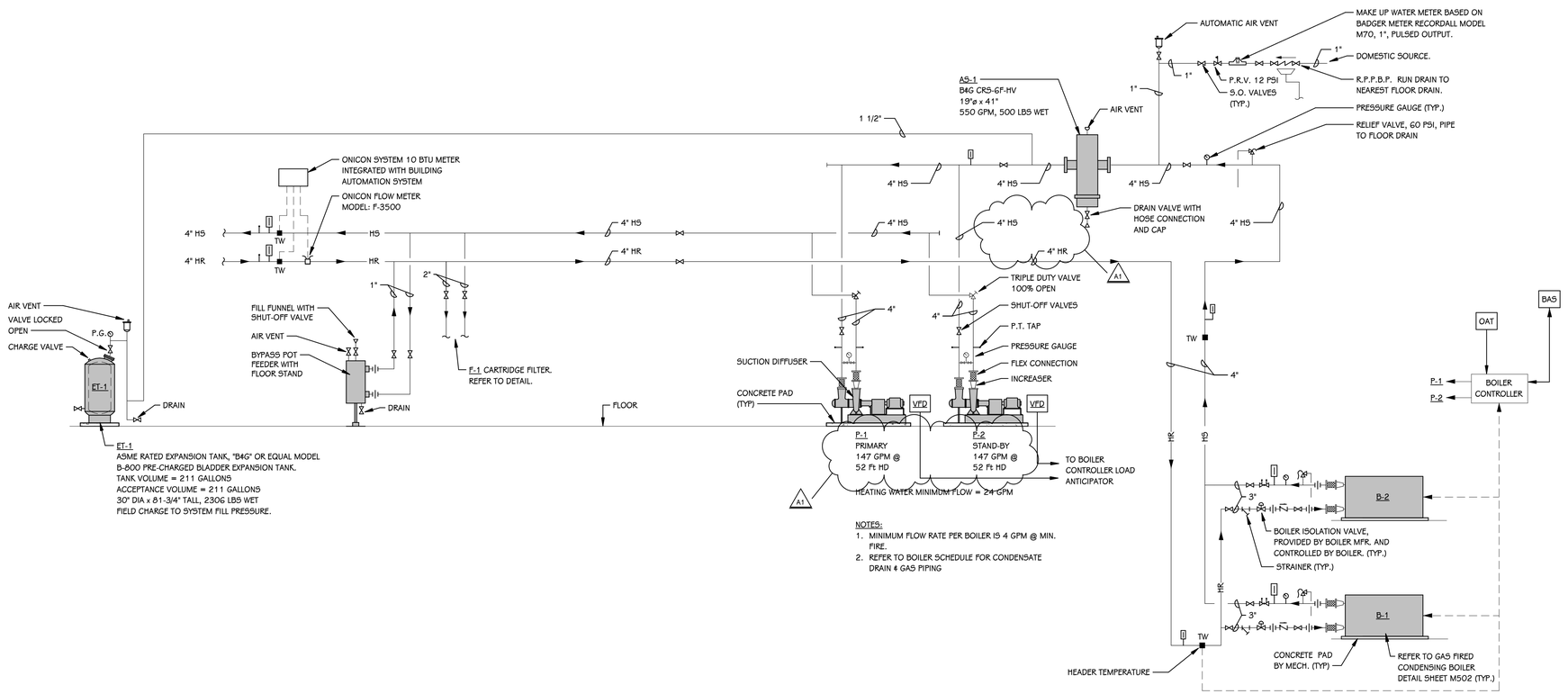
M 301
18-502.00




## CARTRIDGE FILTER PIPING DETAIL (F-1)

SCALE: NONE




## HEATING WATER PIPING SCHEMATIC

SCALE: NONE

NOTES:
1. MINIMUM FLOW RATE PER BOILER IS 4 GPM @ MIN. FIRE.
2. REFER TO BOILER SCHEDULE FOR CONDENSATE DRAIN & GAS PIPING

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KALAMAZOO PUBLIC SCHOOLS

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SHEET TITLE
HVAC PIPING SCHEMATICS

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
M 401
18-502.00

## TERMINAL UNITS — BASED ON TITUS

| MARK | MAX CFM | TYPE | NC (MAX) | SP DROP (MAX) | INLET SIZE | REHEAT COIL MBH | REHEAT COIL TR | REHEAT COIL W.P.D. | REHEAT COIL GPM | MIN CFM | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TU-001 | 100 | DESV | 25 | 0.4" | 04 | 4.3 | 40 | 5' MAX | 0.50 | 33 | 1 |
| TU-002 | 150 | DESV | 25 | 0.4" | 05 | 6.5 | 40 | 5' MAX | 1.00 | 50 | 1 |
| TU-100 | 600 | DESV | 25 | 0.4" | 10 | 26.0 | 40 | 5' MAX | 4.00 | 200 | 1 |
| TU-101 | 600 | DESV | 25 | 0.4" | 10 | 26.0 | 40 | 5' MAX | 4.00 | 200 | 1 |
| TU-101A | 350 | DESV | 25 | 0.4" | 08 | 15.2 | 40 | 5' MAX | 3.25 | 117 | 1 |
| TU-102 | 1,200 | DESV | 25 | 0.4" | 14 | 52.1 | 40 | 5' MAX | 6.50 | 400 | 1 |
| TU-107 | 500 | DESV | 25 | 0.4" | 10 | 21.7 | 40 | 5' MAX | 2.25 | 167 | 1 |
| TU-109 | 100 | DESV | 25 | 0.4" | 04 | 4.3 | 40 | 5' MAX | 0.50 | 33 | 1,2 |
| TU-110 | 1,150 | DESV | 25 | 0.4" | 14 | 49.9 | 40 | 5' MAX | 4.00 | 383 | 1,2 |
| TU-110A | 305 | DESV | 25 | 0.4" | 06 | 13.2 | 40 | 5' MAX | 2.50 | 102 | 1 |
| TU-118 | 1,250 | DESV | 25 | 0.4" | 14 | 54.3 | 40 | 5' MAX | 6.50 | 417 | 1,2 |
| Grand total: 11 | | | | | | 273.6 | | | | | |

NOTES:
1 COIL SIZING BASED ON 130°F EWT, 110°F LWT, W/ BOX AT MAXIMUM FLOW.
2 PROVIDE MODULATING 3-WAY VALVE. REFER TO DETAIL.

## GRILLES, REGISTERS, & DIFFUSERS — BASED ON PRICE

| MARK | PANEL SIZE | FACE SIZE | NECK SIZE | MODEL | CFM RANGE | VCD | MATERIAL | FINISH | INSTALLATION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| SA-1 | 24x24" | 24x24" | 10" Ø | A5CDA | 250 - 400 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| SA-2 | 24x24" | 24x24" | 8" Ø | A5CDA | 120 - 250 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| SA-3 | 24x24" | 24x24" | 6" Ø | A5CDA | 0 - 150 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| SA-4 | 24x24" | 12x12" | 6" Ø | A5CDA/P | 0 - 150 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| SA-5 | - | 10X8" | - | 610 | 0 - 250 | NO | ALUMINUM | WHITE | SIDEWALL | 1 |
| SA-6 | - | 10x10" | - | 610 | 250 - 500 | NO | ALUMINUM | WHITE | SIDEWALL | 1 |
| SA-7 | - | 10x10" | - | 610 | 250 - 500 | NO | ALUMINUM | WHITE | SIDEWALL | 1,2 |
| SA-8 | | 18X10"" | - | 610 | 500 - 750 | NO | ALUMINUM | WHITE | SIDEWALL | |
| | | | | | | | | | | |
| RA-1 | 24x24" | 24x24" | 24X24" | 80 | 500 - 2000 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| RA-2 | 24x24" | 12x12" | 12X12" | 80 | 0 - 500 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| RA-3 | - | 10X10" | - | 630 | 0 - 250 | NO | ALUMINUM | WHITE | SIDEWALL | 1 |
| RA-4 | - | 12x12" | - | 630 | 250 - 500 | NO | ALUMINUM | WHITE | SIDEWALL | 1 |
| | | | | | | | | | | |
| EA-1 | 24x24" | 12x12" | 12x12" | 80 | 0 - 500 | NO | ALUMINUM | WHITE | LAY-IN | 1 |
| EA-2 | - | 10X10" | - | 630 | 0 - 300 | NO | ALUMINUM | WHITE | SIDEWALL | 1 |

NOTES:
1 FIELD PAINT TO MATCH ARCH.
2 VENTILATION PROVIDED FROM AHU-1 RELIEF DUCT.

## PUMPS — BASED ON BELL & GOSSETT

| MARK | MODEL | FLOW RATE (GPM) | HEAD (FT) | PEIcl | MOTOR DATA HP | MOTOR DATA BHP | MOTOR DATA RPM | MOTOR DATA VOLTAGE | LOCATION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | 2BD | 147 | 53 | 0.85 | 5 | 2.6 | 1549 | 480/3 | MECH/ELEC 114 | 1,2 |
| P-2 | 2BD | 147 | 53 | 0.85 | 5 | 2.6 | 1549 | 480/3 | MECH/ELEC 114 | 1,2 |
| P-3 | ecocirc 20-13 | 2 | 5 | | 0.1 | 0 | 2692 | 115/1 | MECH/ELEC 114 | 3 |
| P-4 | ecocirc XL 65-130 | 30 | 25 | | 1 | 0.396 | 2207 | 208/1 | MECH/ELEC 114 | 3 |
| P-5 | ecocirc XL 55-45 | 12 | 27 | | 0.5 | 0.224 | 3352 | 208/1 | KITCHEN 108 | 3 |

NOTES:
1. VFD PROVIDED BY TEMPERATURE CONTROLS CONTRACTOR.
2. WET ROTOR PUMP WITH INTEGRATED VARIABLE FREQUENCY DRIVE AND BMS COMMUNICATIONS. ALL AVAILABLE POINTS SHALL BE REVEALED TO THE BMS.
3. CAST IRON CIRCULATOR

## UNIT HEATER - HOT WATER — BASED ON MODINE

| MARK | MODEL | TYPE | CFM | MBH | GPM | WPD | HP | RPM | VOLTAGE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| UH-110A | H5B-121 | HORIZONTAL | 1,775 | 45.1 | 9.7 | 3.3 | 1/5 | 1075 | 115/1 | 1 |
| UH-110B | H5B-121 | HORIZONTAL | 1,775 | 45.1 | 9.7 | 3.3 | 1/5 | 1075 | 115/1 | 1 |
| UH-110C | H5B-121 | HORIZONTAL | 1,775 | 45.1 | 9.7 | 3.3 | 1/5 | 1075 | 115/1 | 1 |
| UH-111A | H5B-108 | HORIZONTAL | 2,010 | 36.4 | 8.7 | 2.8 | 1/8 | 1625 | 115/1 | 1 |
| UH-111B | H5B-108 | HORIZONTAL | 2,010 | 36.4 | 8.7 | 2.8 | 1/8 | 1625 | 115/1 | 1 |
| UH-111C | H5B-108 | HORIZONTAL | 2,010 | 36.4 | 8.7 | 2.8 | 1/8 | 1625 | 115/1 | 1 |
| UH-112 | H5B-86 | HORIZONTAL | 1,340 | 30 | 6.3 | 1 | 1/8 | 1625 | 115/1 | 1 |
| UH-112A | H5B-63 | HORIZONTAL | 1,120 | 20 | 4.7 | 0.6 | 1/8 | 1625 | 115/1 | 1 |

NOTES:
1. BASED ON 130°F EWT, 60°F EAT.

## CABINET UNIT HEATERS - HOT WATER — BASED ON MODINE

| MARK | MODEL | TYPE | AIRFLOW (CFM) | HEATING COIL MBH | HEATING COIL GPM | HEATING COIL WPD | MOTOR DATA HP | MOTOR DATA RPM | MOTOR DATA VOLTAGE | MOTOR DATA PHASE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH-001 | CW-006 | WALL RECESSED | 650 | 40 | 4.56 | 3.10 ftH2O | 0.4 | 1625 | 115 | 1 | 1,2 |

NOTES:
1. BASED ON 130°F EWT, 20°F dT.
2 BASED ON A 3 ROW COIL

## EXHAUST FANS — BASED ON GREENHECK

| MARK | MODEL | TYPE | AIR FLOW (CFM) | ESP (IN WC) | SONES | MOTOR EC MOTOR | MOTOR NOMINAL HP | MOTOR BRAKE HP | MOTOR RPM | MOTOR VOLTAGE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EF-1 | G-070-VG | DOWNBLAST | 200 | 0.45 | 5.6 | Yes | 0.067 | 0.03 | 1708 | 115/1 | 1,2 |
| EF-2 | G-060-VG | DOWNBLAST | 100 | 0.35 | 4.3 | Yes | 0.067 | 0.02 | 1685 | 115/1 | 1,2 |
| EF-3 | G-090-VG | DOWNBLAST | 500 | 0.35 | 6.6 | Yes | 0.1 | 0.06 | 1448 | 115/1 | 1,2 |
| EF-4 | G-060-VG | DOWNBLAST | 100 | 0.35 | 4.3 | Yes | 0.067 | 0.02 | 1685 | 115/1 | 1,2 |
| EF-5 | G-180-VG | DOWNBLAST | 2200 | 0.64 | 8.2 | Yes | 0.75 | 0.38 | 835 | 115/1 | 1,2 |

NOTES:
1. PROVIDE WITH VARI-GREEN MOTOR.
2. MOTORIZED DAMPER BY TEMPERATURE CONTROLS.

## SOUND TRAP SCHEDULE — BASED ON PRICE

| MARK | CFM | MODEL | TYPE | DIMENSIONS DIAMETER | DIMENSIONS HEIGHT | DIMENSIONS WIDTH | DIMENSIONS LENGTH | P.D. | VELOCITY (FPM) | DUCT SERVICE | MINIMUM REQUIRED LOSS (dB) 63 OCT. | 125 OCT. | 250 OCT. | 500 OCT. | 1K OCT. | 2K OCT. | 4K OCT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ST-1 | 3,500 | RM60/2G | FORWARD | | 24" | 28" | 60" | 0.16 | 750 | ERU-1 SA | 7 | 11 | 21 | 39 | 43 | 37 | 27 | 1,3 |
| ST-2 | 3,300 | RM60/6D | FORWARD | | 16" | 24" | 60" | 0.19 | 1238 | ERU-1 RA | 5 | 11 | 20 | 35 | 29 | 21 | 14 | 1,3 |
| ST-3 | 7,000 | C5 | FORWARD | 24" | | | 96" | 0.27 | 2228 | AHU-1 SA | 13 | 22 | 34 | 44 | 50 | 36 | 26 | 2,4 |
| ST-4 | 7,000 | RM84/2C | FORWARD | | 26" | 28" | 84" | 0.19 | 1385 | AHU-1 RA | 6 | 11 | 21 | 41 | 42 | 34 | 22 | 2,3 |

NOTES:
1. BASED ON NC-35 RECIEVER
2. BASED ON NC-30 RECIEVER.
3 BASED ON 22 GA GALVANIZED CASING AND PERF LINER.
4 BASED ON 18 GA GALVANIZED CASING AND 22 GA GALVANIZED PERF LINER.

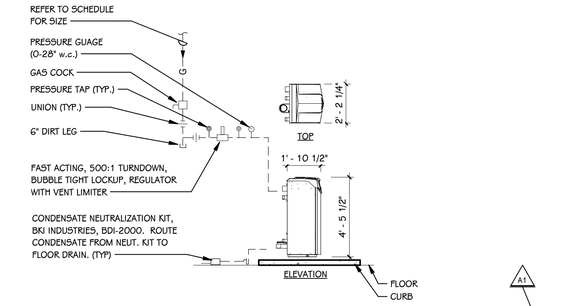
## HEATING COILS - HOT WATER — BASED ON DAIKIN

| MARK | SIZE | ROWS | CFM | TMBH (1) | E.A.T. (°F) | L.A.T. (°F) | GPM | A.P.D. (IN WC) | W.P.D. (FT) | MAX AIR VELOCITY (FPM) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HC-1 | 24" x 42" | 3 | 3,500 | 171 | 50 | 95 | 12 | 0.32 | 12.30 | 500 | 1,2 |

NOTES:
1. BASED ON 130°F EWT, 100°F LWT.
2 PROVIDE MODULATING 3-WAY VALVE. REFER TO DETAIL.

## OUTDOOR AIR INTAKE / RELIEF HOODS — BASED ON GREENHECK

| MARK | MODEL | THROAT SIZE | HOOD SIZE | CURB HEIGHT | AIR FLOW (CFM) | MAX APD (IN WC) | CONTROL DAMPER | REMARKS |
|---|---|---|---|---|---|---|---|---|
| IH-1 | FGI | 16" x 60" | 38" x 87" | 3' - 5" | 7,000 | 0.10 | Yes | |
| IH-2 | FGI | 18" x 28" | 36" x 51" | 3' - 5" | 2,200 | 0.06 | Yes | |
| RH-1 | FGR | 16" x 60" | 34" x 75" | 3' - 5" | 7,000 | 0.10 | Yes | |




BASED ON "LOCHINVAR" MODEL: FTX 725N. 97.2% THERMAL EFFICIENCY (AHRI), 5-14" w.g. INLET NAT.GAS PRESSURE, 30°F T.R., DUCTED AIR INLET AND EXHAUST. VENT PER MFR RECOMMENDATIONS. PROVIDE WITH CONTROL VALVE AND GAS REGULATOR.

| MARK | MODEL | OUTPUT | GPM | MIN. FLOW | GAS LINE | AIR | VENT | SERVICE | WATER PD |
|---|---|---|---|---|---|---|---|---|---|
| B-1 | FTX 725N | 705 MBH | 150 | 20 | 2-1/2" | 4" | 6" | HEATING WATER | 13' @ 147 GPM |
| B-2 | FTX 725N | 705 MBH | 150 | 20 | 2-1/2" | 4" | 6" | HEATING WATER | 13' @ 147 GPM |

### GAS-FIRED CONDENSING BOILERS B-1 & B-2
SCALE: NONE

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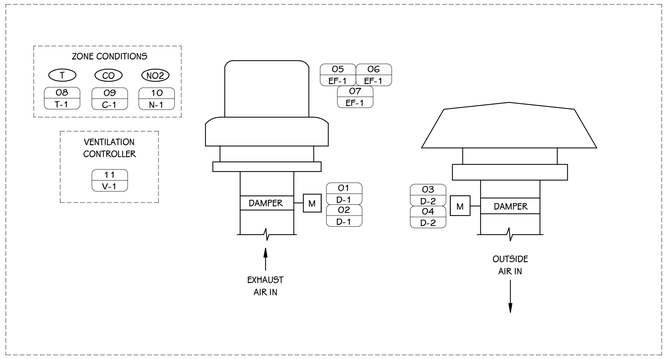
KALAMAZOO PUBLIC SCHOOLS
Kalamazoo, Michigan

DATE
SEPTEMBER 20, 2024

SHEET TITLE
MECHANICAL SCHEDULES

SHEET NUMBER
M 502
18-502.00




GAS DETECTION AND VENTILATION SYSTEM CONTROLS DIAGRAM

SCALE: NONE

## CONTROL POINTS

| NUMBER | TAG | DESCRIPTION | ALARM | TREND | REMARKS |
|---|---|---|---|---|---|
| GAS DETECTION AND VENTILATION | | | | | |
| 01 | D-1 | EXHAUST AIR DAMPER OUTPUT | | ∎ | CONTROLLED BY VENTILATION CONTROLLER. |
| 02 | D-1 | EXHAUST AIR DAMPER POSITION | | ∎ | CONTROLLED BY VENTILATION CONTROLLER. |
| 03 | D-2 | OUTSIDE AIR DAMPER OUTPUT | | ∎ | CONTROLLED BY VENTILATION CONTROLLER. |
| 04 | D-2 | OUTSIDE AIR DAMPER POSITION | | ∎ | CONTROLLED BY VENTILATION CONTROLLER. |
| 05 | EF-1 | FAN ENABLE/DISABLE | | ∎ | SENT FROM BAS (SYSTEM) VENTILATION CONTROLLER |
| 06 | EF-1 | FAN SPEED CONTROL | | ∎ | |
| 07 | EF-1 | FAN STATUS | ∎ | ∎ | MODBUS/BACNET DATA. |
| 08 | T-1 | ZONE AIR TEMPERATURE | | ∎ | |
| 09 | C-1 | ZONE CARBON MONOXIDE LEVEL | ∎ | ∎ | |
| 10 | N-1 | ZONE NITROGEN DIOXIDE LEVEL | ∎ | ∎ | |
| 11 | V-1 | VENTILATION SYSTEM ALARM STATUS | ∎ | ∎ | |

## SEQUENCE OF OPERATIONS

GAS DETECTION & VENTILATION CONTROLS

1. PROVIDE DIRECT DIGITAL CONTROLS (DDC) FOR GAS DETECTION & VENTILATION SYSTEM MONITORING. DDC SHALL MONITAR AND ALARM. FACTORY CONTROLLER SHALL SENSE GASES AND CONTROL DAMPERS AND FAN(S). SYSTEM IS A COMBINATION OF A CONSTANT VOLUME EXHAUST FAN, ISOLATION INLET AND INTAKE DAMPERS AND ACTUATORS, CO AND NO2 SENSORS, AND FACTORY CONTROLLER.
2. EF-5 TO RUN ON RISE IN GAS LEVELS.
3. SYSTEM START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
   A. WHEN GASES ARE BELOW 25 PPM CO AND/OR 0.7 PPM NO2: DISABLE EXHAUST FAN.
      a. ISOLATION AIR DAMPER 100% CLOSED.
      b. INTAKE HOOD AIR DAMPER 100% CLOSED.
   B. WHEN GASES ARE >25 PPM CO AND/OR >0.7 PPM NO2: ENABLE EXHAUST FAN
      a. ISOLATION AIR DAMPER 100% OPENED.
      b. INTAKE HOOD AIR DAMPER 100% OPENED.
4. SYSTEM DDC MONITORING AND ALARMING OF THE FOLLOWING:
   A. WHEN GASES ARE >100 PPM CO AND/OR >2 PPM NO2 FOR 5 MINUTES:
      a. ISOLATION AIR DAMPER 100% OPENED.
      b. INTAKE HOOD AIR DAMPER 100% OPENED.
      c. THE DDC SHALL INDICATE A CRITICAL ALARM.
   B. EXHAUST FAN MOTOR STATUS:
      a. WHEN ENABLED, AND AFTER A DELAY OF TWO (2) MINUTES (ADJ.) WITH NO STATUS SENSED, THE DDC SHALL INDICATE A GENERAL ALARM.
      b. WHEN ENABLED AND STATUS IS SENSED BY THE CURRENT SENSOR, A TOTALIZES OF RUN HOURS FOR EXHAUST FAN WILL BE ACTIVE.
5. ALARMS:
   A. VENTILATION CONTROLLER LOCAL DISPLAY WITH AUDIBLE ALARM, FIRE ALARM, BAS
   B. MANUAL RESET OF VISUAL AND AUDIBLE PANEL ALARMS IS REQUIRED AFTER ALARM CONDITION.

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Kalamazoo, Michigan

DATE
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SHEET TITLE
MECHANICAL CONTROLS

SHEET NUMBER
M 604
18-502.00

A1

## SITE LIGHT FIXTURE SCHEDULE

| TYPE | DESCRIPTION | MOUNTING | MANUFACTURER | NOTES |
|---|---|---|---|---|
| SA4H | AREA SITE LIGHT | 25' ROUND TAPERED AL POLE | LITHONIA #DSX1LED P3 40K 80CRI T4M MVOLT (MTG) BL30 (COLOR) HS OR EQUAL BY CREE EDGE OR EQUAL BY COOPER McGRAW EDISON A1 | 1, 2 |
| SA5 | AREA SITE LIGHT | 25' ROUND TAPERED AL POLE | LITHONIA #DSX1LED P3 40K 80CRI T3M MVOLT (MTG) BL30 (COLOR OR EQUAL BY CREE EDGE OR EQUAL BY COOPER McGRAW EDISON A1 | 1, 2 |

1 ALL LED FIXTURES TO HAVE WARRANTY TO MEET OR EXCEED WARRANTY INCLUDED IN BASIS OF DESIGN. FIXTURES LISTED AS EQUALS SHALL MEET DELIVERED LUMENS, CRI, EFFICACY AND OPTIONS OF THAT SPECIFIED. REFER TO SPECIFICATIONS 265100 AND 265600 FOR ADDITIONAL REQUIREMENTS.

2 THE MOUNTING DESCRIPTION IS GENERAL. REFER TO SHOP DRAWINGS AND MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR SPECIFIC MOUNTING DETAILS.

## ELECTRICAL SITE GENERAL NOTES

1 WIRE UPSIZING IS NOTED WHERE APPROPRIATE TO ACCOMMODATE FOR VOLTAGE DROP. WIRE SIZES SHALL BE #10 UNLESS OTHERWISE NOTED.

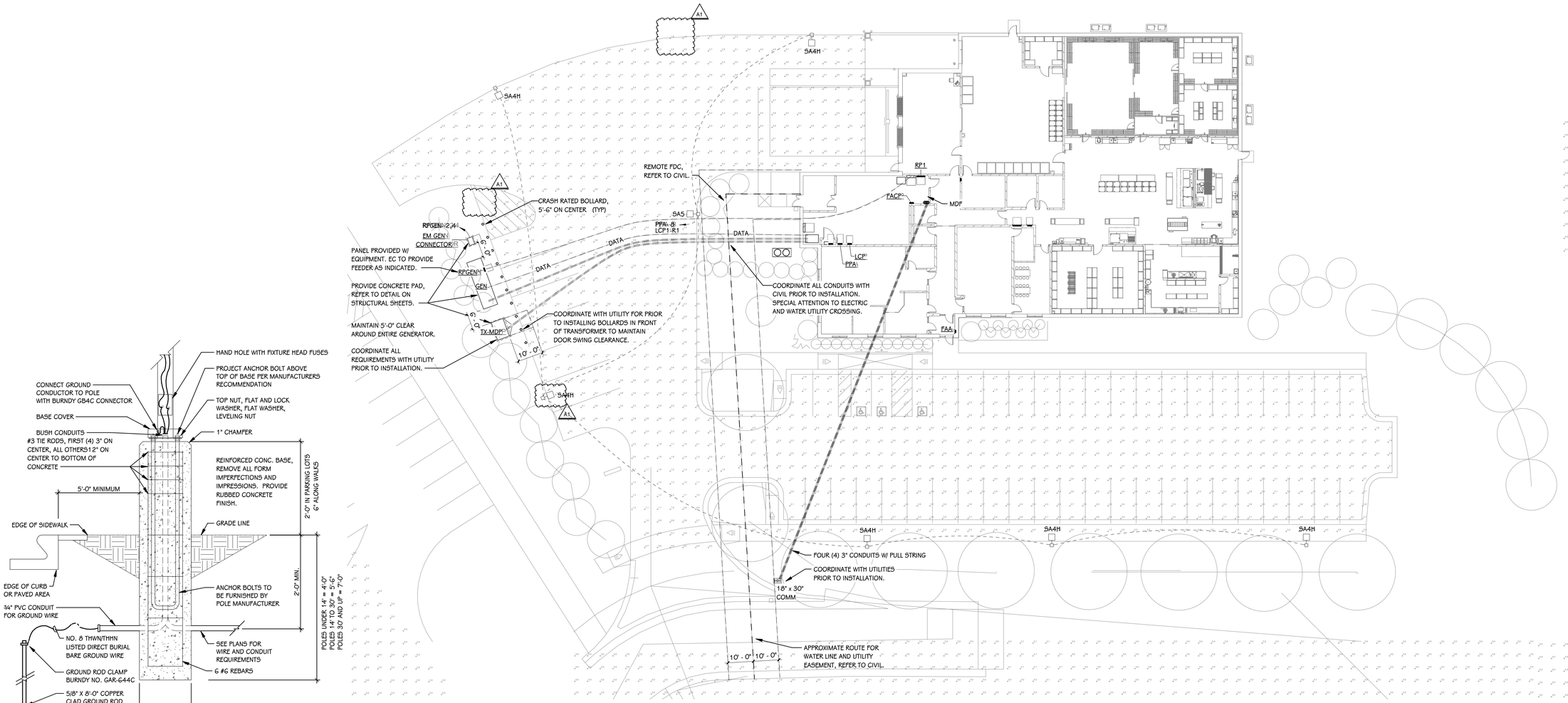
2 WIRE UPSIZING SHOWN IS ONLY ACCURATE FOR THE WIRING CONFIGURATION SHOWN. CONTRACTOR SHALL ENSURE THAT ALL VOLTAGE DROP REQUIREMENTS ARE MET IF WIRING CONFIGURATION CHANGES.

3 WHERE VOLTAGE DROPS ARE NOT SHOWN, CONTRACTOR SHALL PROPERLY SIZE FEEDER WIRE.

4 PROVIDE TRENCHING AND DIRECTIONAL BORING AS REQUIRED FOR ALL ELECTRICAL SITE WORK. REFER TO SITE / CIVIL UTILITY PLAN AND CALL MISS DIG PRIOR TO ANY SITE TRENCHING OR DIRECTIONAL BORING.

5 ALL CONDUITS SHALL ENTER/EXIT THE BUILDING BELOW GRADE. CUT AND PATCH AS REQUIRED. NO EXPOSED CONDUIT SHALL BE ALLOWED.

6 ALL CONDUITS FOR COMMUNICATIONS AND FUTURE POWER SHALL HAVE PULL STRING.







LIGHTING POLE BASE DETAIL
SCALE: NONE

ELECTRICAL SITE PLAN
1" = 20'-0"

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SHEET TITLE
ELECTRICAL SITE PLAN

DATE
SEPTEMBER 20, 2024

SHEET NUMBER
ES 101
18-502.00

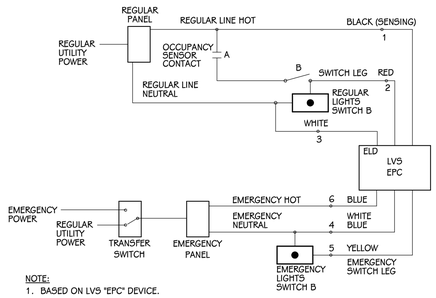
## LIGHT FIXTURE SCHEDULE

| TYPE | DESCRIPTION | MOUNTING | DRIVER | MANUFACTURER | NOTES |
|---|---|---|---|---|---|
| BA | LED WALL PACK | SURFACE | 0-10V | LITHONIA #DSXW1LED-20C-530-40K-TFTM-MVOLT-(COLOR)<br>OR EQUAL BY CREE<br>OR EQUAL BY COOPER GAW GALLEON A1 | 1, 2, 3 |
| BB | DOWNLIGHT | RECESSED | 0-10V | KERLIN LIGHTING #LRC10KLD-5000L-277V-40K-(CUSTOM COLOR)-23 FROSTED LENS A1<br>OR APPROVED EQUAL | 1, 2, 3 |
| H | SURFACE WRAP, 4' - 0" LONG | SURFACE | 0-10V | KENALL #MLHA8-48-F-(COLOR)-FP-45L40K-DV-DL-F5-PH<br>OR EQUAL BY NEW STAR A1<br>OR EQUAL BY FAIL SAFE | 1, 2, 3 |
| IA | INDUSTRIAL | PENDANT | 0-10V | LITHONIA #TZL1N-L48-5000LM-FST-MVOLT-40K-80CRI-WH<br>OR EQUAL BY COLUMBIA A1<br>OR EQUAL BY METALUX | 1, 2, 3 |
| M | , 2' - 0" LONG | RECESSED | 0-10V | BROWNLEE #5174-37"-(OPTIONAL)-H31-40K<br>OR EQUAL BY<br>OR EQUAL BY SAL VETRO 30" A1 | 1, 2, 3 |
| RA | 2x2 TROFFER, 2' - 0" LONG | RECESSED | 0-10V | FINELITE #HPR-LED-A-2X2-DCO-B-840-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS LIGHTING | 1, 2, 3 |
| RB | 2x2 TROFFER, 2' - 0" LONG | RECESSED | 0-10V | FINELITE #HPR-LED-A-2X2-DCO-H-840-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS LIGHTING | 1, 2, 3 |
| RDG | A1 4" LINEAR, GYP, 6' - 0" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-6'-D-V-840-F-277-SC-SF A1<br>OR EQUAL BY PINNACLE<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| RDG'4 | 4" LINEAR, GRID, 6' - 4" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-6'-4"-D-V-840-F-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| RD7'1 | 4" LINEAR, GRID, 7' - 1" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-7'-1"-D-V-840-F-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| RG4 | 4" LINEAR, GRID, 4' - 0" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-4'-D-V-840-F-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| RG6 | 4" LINEAR, GRID, 6' - 0" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-6'-D-V-840-F-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| RG12 | 4" LINEAR, GRID, 12' - 0" LONG | RECESSED | 0-10V | FINELITE # HP-4-R-12'-D-V-840-F-277-SC-C1<br>OR EQUAL BY PINNACLE A1<br>OR EQUAL BY AXIS BEAM 4 | 1, 2, 3 |
| X1 | EXIT SIGN -SINGLE FACE | UNIVERSAL | 0-10V | LITHONIA #LQC-W-1-R<br>OR EQUAL BY DUAL LITE A1<br>OR EQUAL BY SURE LITES | 1, 2 |

1 ALL LED FIXTURES TO HAVE WARRANTY TO MEET OR EXCEED WARRANTY INCLUDED IN BASIS OF DESIGN. FIXTURES LISTED AS EQUALS SHALL MEET DELIVERED LUMENS, CRI, EFFICACY AND OPTIONS OF THAT SPECIFIED. REFER TO SPECIFICATIONS 265100 AND 265600 FOR ADDITIONAL REQUIREMENTS.

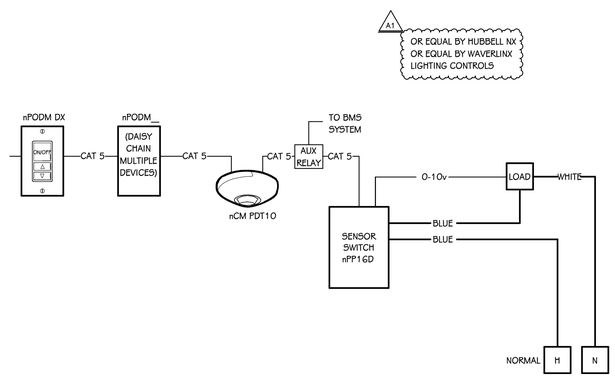
2 THE MOUNTING DESCRIPTION IS GENERAL. REFER TO SHOP DRAWINGS AND MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR SPECIFIC MOUNTING DETAILS.

3 FIXTURES WITH THE CENTER CIRCLE SHADED SHALL BE CONNECTED TO EMERGENCY POWER. FIXTURES WITH CENTER CIRCLE SHADED THAT ARE SWITCHED SHALL BE PROVIDED WITH BODINE "ELD" TRANSFER DEVICE. FOR INDIVIDUAL FIXTURES DEVICE SHALL BE MOUNTED INTERNAL TO THE FIXTURE. PROVIDE LABEL ON INSIDE OF FIXTURE INDICATING FED FROM MULTIPLE CIRCUITS. WHERE DEVICE CANNOT BE MOUNTED INSIDE OF FIXTURE, MOUNT ADJACENT TO FIXTURE IN ACCESSIBLE CEILING SPACE.

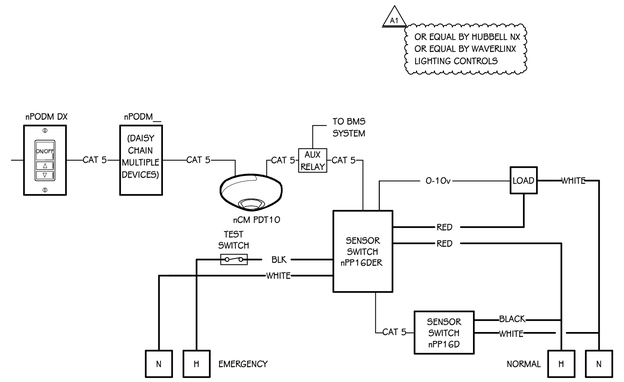



NOTE:
1. BASED ON LVS "EPC" DEVICE.
2. FOR CLARITY, INTERNAL COMPONENTS NOT SHOWN.
3. CONTACT A AND SWITCH B TURNS ON AND OFF BOTH REGULAR LOAD AND EMERGENCY LOAD.
4. SINGLE LINE DIAGRAM NEUTRAL NOT SHOWN.

SWITCHED EMERGENCY LIGHT FIXTURE "ELD" WIRING DIAGRAM
SCALE: NONE




OCCUPANCY SENSOR WIRING DIAGRAM
SCALE: NONE




EMERGENCY
OCCUPANCY SENSOR WIRING DIAGRAM
SCALE: NONE

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