division of
Facilities Construction
and Management

DFCM Addendum #6

Reference: Bastian Equestrian Arena
DFCM Project #25401770
U3P Event #CS25039-Stage II

Date: April 22, 2025

To: Shortlisted Contractors

From: The Division of Facilities Construction and Mangement

Addendum Items

Solicitation Schedule Changes:	No changes.	N/A
DFCM Addendum Items:	None	
A/E Addendum Items:	A/E Addendum This addendum consists of the following: Clarification requests provided to bidders from Utah State University facilities. Spectrum Engineers has provided the attached response narrative document hereafter that address each of the questions /clarifications. Approved Alternate Products.	109
	Total Attached Pages:	**109**

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Bidders are required to acknowledge receipt of this Addendum when their bid is submitted. Failure to do so may subject the Bidder to disqualification.

METHOD STUDIO INC.
DFCM
Division of Facilities Construction and Management
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ADDENDUM NO. 6
April 21, 2025

USU Bastian Equestrian Arena

Project# 25401770

The original specifications dated February 20, 2025 and drawings dated January 31, 2025 for the project referenced above are amended in Addendum No. 1, dated April 3, 2025.

Receipt of this addendum shall be acknowledged by inserting its number and date in the space provided on the bid form.

This addendum consists of the following:

Below are clarification requests provided to bidders from Utah State University facilities. Spectrum Engineers has provided the attached response narrative documents hereafter that address each of the questions/clarifications below. Due to procurement protocols thru DFCM any requests for sole-sourcing products or companies by USU are being provided by Spectrum as “basis of design” items in their drawings and specs. But these requests show the bidders USU’s preferences based on their standards.

Utah State Facilities comments:

The fire alarm system used on USU projects is typically a Notifier system. Notifier is what our staff is familiar with, and what they have found to be a best value in terms of cost as well as durability & functionality. The note I have from the electrical shop foreman is:

- Graphic Annuciator – Notifier
- FACP – Notifier
- Pull Boxes – Notifier
- Smokes – Notifier
- Heats – Thermotech
- Air Sampling Smokes – Notifier
- Notification – System Sensor are to be Red

Additionally, I have the following comments from plumbing:

1) 1-P101 custodial, could the floor sink have a full grate or use a floor drain instead so there isn’t a void for mop buckets or people to fall into?
2) 2-P004 Hb-1 non-freeze hose bib, could we use an external hose bib that is easy to maintain and replace like the chicago293cp? The watts HY-420 currently scheduled is 8” long and would not fit in the walls.
3) 3-P002 D4 water header detail. Could we have the shutoff valve and a y strainer before the backflow preventer to protect the backflow preventer from debris and shut off water for maintenance to backflow preventer?
4) 4-P003 B4 water heater detail. Could we detail what the platform is for supporting the water heater?
5) 5-P101 D1 custodial 100 shows a 4” WCO in a 3-5/8” wall. Could we do a floor clean out or a 6” wall?

6) 6-I do not see a spec section for Domestic water piping, Domestic water piping specialties or Natural gas piping.

Item 6 is important in that we do not typically allow PEX to be used on commercial projects. Without a specification section identifying this, we often see PEX bid.

Additional comments from USU Facilities:

1. The file attached to this email is the USU Electrical Design Requirements as found on the USU facilities website. Requirements for the fire alarm system start on page 28. At the bottom of page 30 is the statement that the only approved fire alarm system vendor is Notifier. This document was last updated in 2009. In talking with Ken, we are not sure if we have a sole source letter. If not, we will get one. This is the only system our staff is trained and authorized to work on. As I understand it, Notifier has the state contract for maintenance and repair at USU.
2. The natural gas piping aboveground spec. allows for corrugated stainless, copper tubing or aluminum tubing. Our design manual calls for schedule 40 with threaded fitting for 2" and smaller and welded fittings for 2-1/2" and larger pipe. We would like the spec changed to match the USU standard.

Response: Spectrum Engineers has provided the following attached items to address the two comments above

1) Addendum #6 narrative
2) Updated gas spec
3) Updated fire alarm riser drawing

Approved alternate products:

Substitution Request #1: McKeon Doors (IS3000 series) are proposed as an alternate product for the Overhead Coiling Door product being specified. THIS SUBSTITUTION REQUEST IS APPROVED.

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MEP Addendum #6

Date:	April 17, 2025		
To:	Kelly Morgan	**From:**	Tyler Anderson
Company:	Method Studio	**Email:**	Tyler.anderson@speceng.com
Job:	USU Bastian Center	**Phone:**	801.328.5151
Job No:	240226	**Re:**	
Cc:			

This Addendum shall be considered part of the Contract Documents and Project Manual for the above mentioned project as though it had been issued at the same time and shall be incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original Contract Documents and Project Manual, the Addendum shall govern and take precedence.

Mechanical Addendum

Drawings

1. M003:
    a. Clarified that exhaust fan is EC motor.
    b. Added additional acceptable manufacturers to damper schedule.

Plumbing Addendum

Specifications

1. 221116 – DOMESTIC WATER PIPING
    a. Previously not provided with specifications. Now included.
2. 231123 – FACILITY NATURAL-GAS PIPING
    a. Previously not provided with specifications. Now included.

Drawings

1. P002:
    a. Revised PRV station detail.
        i. Showing shut off valve prior to all equipment

ii. Showing backflow preventer next with y strainer. Note included for y strainer to be before backflow preventer.
iii. Shut off valve added to end of station.

2. P003:

    a. Added text note to clarify type of angle irons.
        i. In response to client question for what the platform is that supports water heater, detail previously called for sheet metal as the platform.

3. P004:

    a. Revised wall cleanout selection to floor cleanout selection.
    b. Changed selection of half grate floor sink selection to full grate floor sink.
    c. Revised HB-1 to Chicago 293CP.

4. P101:

    a. Changed half grate floor sink to full grate floor sink
    b. Changed wall cleanout to floor cleanout

Electrical Addendum

Specifications

3. 284621.11 – Addressable Fire-Alarm Systems:

    a. 2.4.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    b. 2.6.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    c. 2.7.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    d. 2.12.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    e. 2.13.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    f. 2.14.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.
    g. 2.14.b: Add “System Sensors are to be red” to section.
    h. 2.18.a: Update section to state “owner prefers Notifier brand systems” and move Notifier to the top of the manufacturers list.

END OF ADDENDUM

Attachments M003, 221116, 231123, P002, P003, P004, P101 284621.11

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings - domestic water.
2. Piping joining materials - domestic water.
3. Encasement for piping.
4. Transition fittings - domestic water.
5. Dielectric fittings - domestic water.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.5 WARRANTY

A. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.3 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 4.

D. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Do not use solder joints on pipe sizes greater than NPS 4.

E. Copper-Tube, Mechanically Formed Tee Fitting - Domestic Water: For forming T-branch on copper water tube.

1. Description: Tee formed in copper tube in accordance with ASTM F2014.

F. Grooved, Mechanical-Joint, Copper Tube Appurtenances - Domestic Water:

1. Source Limitations: Obtain grooved, mechanical-joint copper tube appurtenances from single manufacturer.
2. Grooved-End, Copper Fittings: ASTM B75/B75M copper tube or ASTM B584 bronze castings.
3. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 140 deg F, for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.

G. Pressure-Seal-Joint Fittings, Copper or Bronze - Domestic Water:

1. Source Limitations: Obtain pressure-seal-joint fittings, copper or bronze, from single manufacturer.
2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200 psig working-pressure rating at 250 deg F.

2.4 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

B. Form: **tube.**

C. Color: Black.

2.6 TRANSITION FITTINGS - DOMESTIC WATER

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Couplings - Domestic Water: AWWA C219.

1. Source Limitations: Obtain sleeve-type transition couplings from single manufacturer.

D. Plastic-to-Metal Transition Fittings - Domestic Water:

1. Source Limitations: Obtain plastic-to-metal transition fittings from single source.
2. Description:

a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions - Domestic Water:

1. Source Limitations: Obtain plastic-to-metal transition unions from single manufacturer.
2. Description:

a. CPVC four-part union.
b. Brass threaded end.
c. Solvent-cement-joint plastic end.
d. Rubber O-ring.
e. Union nut.

2.7 DIELECTRIC FITTINGS - DOMESTIC WATER

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

B. Dielectric Unions - Domestic Water:

1. Source Limitations: Obtain dielectric unions from single manufacturer.
2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 10 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges - Domestic Water:

1. Source Limitations: Obtain dielectric flanges from single manufacturer.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 140 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits - Domestic Water:

1. Source Limitations: Obtain dielectric-flange insulating kits from single manufacturer.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Phenolic, Temperature Rating: 140 deg F.
5. Bolt Sleeves: Phenolic or polyethylene.

6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples - Domestic Water:

1. Source Limitations: Obtain dielectric nipples from single manufacturer.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F1545.
4. Pressure Rating and Temperature: 150 psig at 140 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

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

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

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

D. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller is to be the following:

1. Annealed-temper copper tube, ASTM B88, Type K wrought-copper, solder-joint fitting and pressure-sealed joints.

E. Aboveground domestic water piping, NPS 2 (DN 50) and smaller is to be the following:

1. Drawn-temper copper tube, ASTM B88, Type L; solder-joint fittings and joints.

3.2 INSTALLATION OF PIPING

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

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement in accordance with ASTM A674 or AWWA C105/A21.5.

D. Install valves in accordance with Section 220523 "General-Duty Valves for Plumbing Piping."

E. Install water-pressure-reducing valves downstream from shutoff valves.

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

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping to permit valve servicing.

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

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment.

M. Install thermometers on inlet and outlet piping from each water heater.

N. Install sleeves for piping penetrations of walls, ceilings, and floors.

O. Install sleeve seals for piping penetrations of concrete walls and slabs.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

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

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

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

H. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

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

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

K. Joint Construction for Grooved-End Steel Piping: Make joints in accordance with AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join in accordance with ASTM D2846/D2846M.
3. PVC Piping: Join in accordance with ASTM D2855.

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

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

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

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for copper pipe, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper pipe to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING CONNECTIONS

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

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

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

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

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.8 IDENTIFICATION

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

3.9 CLEANING

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

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

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system in accordance with either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

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

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

3.10 ADJUSTING

A. Perform the following adjustments before operation:

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

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

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

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

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

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

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

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

C. Prepare test and inspection reports.

END OF SECTION 221116

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Air-sampling smoke detectors.
5. Non-system smoke detectors.
6. Heat detectors.
7. Notification appliances.
8. Device guards.
9. Firefighters' two-way telephone communication service.
10. Firefighters' smoke-control station.
11. Magnetic door holders.
12. Remote annunciator.
13. Graphic annunciator.
14. Addressable interface device.
15. Digital alarm communicator transmitter.
16. Radio alarm transmitter.
17. Network communications.
18. System printer.

B. Related Requirements:

1. Section 271513 "Communications Copper Horizontal Cabling" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

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

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    e. Locate detectors according to manufacturer's written recommendations.
    f. Show air-sampling detector pipe routing.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.

b. NICET-certified, fire-alarm technician; Level IV minimum.
c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

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

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.

e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72 by qualified agent.

1.10 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect Construction Manager Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Architect's Construction Manager's Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment 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 new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Non-coded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

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

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.
6. Air-sampling smoke-detection system (VESDA).
7. Carbon monoxide detectors.
8. Combustible gas detectors.
9. Automatic sprinkler system water flow.
10. Pre-action system.
11. Fire-extinguishing system operation.
12. Fire standpipe system.
13. Dry system pressure flow switch.
14. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Activate pre-action system.

12. Recall elevators to primary or alternate recall floors.
13. Activate elevator power shunt trip.
14. Activate emergency lighting control.
15. Activate emergency shutoffs for gas and fuel supplies.
16. Record events in the system memory.
17. Record events by the system printer.
18. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or pre-action sprinkler system.
3. Alert and Action signals of air-sampling detector system.
4. Elevator shunt-trip supervision.
5. Fire pump running.
6. Fire-pump loss of power.
7. Fire-pump power phase reversal.
8. Independent fire-detection and -suppression systems.
9. User disabling of zones or individual devices.
10. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier brand systems, provide products by one of the following:
1. Notifier.
2. Faraday.
3. Fike Corporation.
4. Fire-Lite Alarms, Inc.; a Honeywell International company.
5. Gamewell - FCI by Honeywell.
6. GE UTC Fire & Security; A United Technologies Company.
7. Keltron Corporation.
8. Mircom Technologies, Ltd.
9. Potter Electric Signal Company, LLC.
10. Siemens Industry, Inc.; Fire Safety Division.
11. Silent Knight.
12. SimplexGrinnell LP.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central-station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

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

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

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

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 1.
3. Install no more than 50 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One dedicated RS 485 port for central-station or remote station operation using point ID DACT.
b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
c. One USB port for PC configuration.
d. One RS 232 port for VESDA HLI connection.
e. One RS 232 port for voice evacuation interface.

F. Stairwell and Elevator Shaft **Pressurization**: Provide an output signal using an addressable relay to start the stairwell and elevator shaft pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

1. Pressurization starts when any alarm is received at fire-alarm control unit.
2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

G. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

H. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

I. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoist way.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

    a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

J. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

K. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

L. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

M. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

    a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

N. Printout of Events: On receipt of 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 same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

O. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

P. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

Q. Instructions: Computer printout 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.

2.5 PRE-ACTION SYSTEM

A. Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a pre-action system shall be annunciated at the FACP only, without activation of the general evacuation alarm.

2.6 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier brand systems, provide products by one of the following:
1. Notifier.
2. Faraday.
3. Federal Signal Corporation.
4. Fike Corporation.
5. Fire-Lite Alarms, Inc.; a Honeywell International company.
6. Gamewell - FCI by Honeywell.
7. GE UTC Fire & Security; A United Technologies Company.
8. Keltron Corporation.
9. Mircom Technologies, Ltd.
10. Potter Electric Signal Company, LLC.
11. Siemens Industry, Inc.; Fire Safety Division.
12. Silent Knight.
13. SimplexGrinnell LP.
14. System Sensor.
15. Wheelock; a brand of Eaton.
16. AMSECO - A Potter Brand.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. 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.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.7 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier brand systems, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Notifier.
2. Faraday.
3. Fenwal Protection Systems; A UTC Fire & Security Company.
4. Fire-Lite Alarms, Inc.; a Honeywell International company.
5. Gamewell - FCI by Honeywell.
6. GE UTC Fire & Security; A United Technologies Company.
7. Gentex Corporation.
8. Harrington Signal, Inc.
9. Keltron Corporation.
10. Mircom Technologies, Ltd.
11. Potter Electric Signal Company, LLC.
12. Siemens Industry, Inc.; Fire Safety Division.
13. Silent Knight.
14. SimplexGrinnell LP.
15. System Sensor.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.

b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
c. Multiple levels of detection sensitivity for each sensor.
d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

D. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.8 PROJECTED BEAM SMOKE DETECTORS

A. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.

B. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.

C. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present average value.
4. Present sensitivity selected.
5. Sensor range (normal, dirty, etc.).

2.9 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.10 MULTI-CRITERIA DETECTORS

A. Mounting: Adapter plate for outlet box mounting.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.11 NON-SYSTEM SMOKE DETECTORS

A. General Requirements for Non-system Smoke Detectors:

1. Non-system smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
2. Non-system smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

B. Single-Station Smoke Detectors:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Auxiliary Relays: One Form A and one Form C, both rated at 0.5 A.
3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
4. Visible Notification Appliance: 177-cd strobe.
5. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and **fixed** temperature.
6. Test Switch: Push to test; simulates smoke at rated obscuration.
7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
10. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

C. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.

    a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.

3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.

a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; listed for use with the supplied detector.

4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.12 HEAT DETECTORS

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

1. Notifier.
2. Faraday.
3. Fire-Lite Alarms, Inc.; a Honeywell International company.
4. Gamewell - FCI by Honeywell.
5. GE UTC Fire & Security; A United Technologies Company.
6. Gentex Corporation.
7. Harrington Signal, Inc.
8. Keltron Corporation.
9. Mircom Technologies, Ltd.
10. Potter Electric Signal Company, LLC.
11. Siemens Industry, Inc.; Fire Safety Division.
12. Silent Knight.
13. SimplexGrinnell LP.
14. System Sensor.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

E. Continuous Linear Heat-Detector System:

1. Detector Cable: Rated detection temperature 155 deg F (68 deg C). Listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.

2. Control Unit: Two-zone or multi-zone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.13 AIR-SAMPLING SMOKE DETECTOR

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier products, provide products by one of the following:
1. Notifier.
2. Ansul; Tyco Fire Protection Products.
3. Fenwal Protection Systems; A UTC Fire & Security Company.
4. Fike Corporation.
5. Xtralis Pty Ltd.

B. General Description:

1. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
2. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
3. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.
4. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
5. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.
6. Pipe airflow balancing calculations shall be performed using approved calculation software.

C. Detector:

1. Detector, Filter, Aspirator, and Relays: Housed in a mounting box and arranged in such a way that air is drawn from the detection area and a sample passed through the dual-stage filter and detector by the aspirator.
2. Obscuration Sensitivity Range: 0.005 - 6 percent obs/ft..
3. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and a programmable scan time delay. The threshold set points shall be programmable.

    a. The four alarm thresholds may be used as follows:

        1) Alarm Level 1 (Alert): Activate a visual and an audible supervisory alarm.
        2) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm.
        3) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
        4) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.

b. Final Detection System Settings: Approved by Architect.
c. Initial Detection Alarm Settings:

1) Alarm Level 1 (Alert): 0.08 percent obs/ft..
2) Alarm Level 2 (Action): 1.0 percent obs/ft..
3) Alarm Level 3 (Fire 1): 2.0 percent obs/ft..
4) Alarm Level 4 (Fire 2): 4.0 percent obs/ft..

4. Power Supply:

a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.
b. Battery backup shall provide 24 hours' standby, followed by 30 minutes at maximum connected load.

5. Detector shall also transmit the following faults:

a. Detector.
b. Airflow.
c. Filter.
d. System.
e. Zone.
f. Network.
g. Power.

6. Provide four in-line sample pipe inlets that shall contain a flow sensor for each pipe inlet. The detector shall be capable of identifying the pipe from which smoke was detected.
7. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 feet (200 m) in total, (four pipe runs per detector) with a transport time of less than 120 seconds from the farthest sample port.
8. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.
9. Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
10. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) shall be capable of storing up to 18,000 events.
11. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms.

D. Displays:

1. Include display module within each detector.
2. Each display shall provide the following features at a minimum:

a. A bar-graph display.
b. Four independent, high-intensity alarm indicators (Alert, Action, Fire 1, and Fire 2), corresponding to the four alarm thresholds of the indicated sector.
c. Alarm threshold indicators for Alert, Action, and Fire 1.
d. LED indication that the first alarm sector is established.
e. Detector fault and airflow fault indicators.
f. LED indicators shall be provided for faults originating in the particular zone (Zone Fault), faults produced by the overall smoke-detection system, and faults resulting from network wiring errors (Network Fault).
g. Minor and urgent LED fault indicators.

E. Sampling Tubes:

1. Smooth bore with a nominal 1-inch (25-mm) OD and a 7/8-inch (21-mm) ID. Sampling pipe with between 5/8- and 1-inch (15- and 25-mm) ID can be used in specifically approved locations when recommended by manufacturer.
2. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."
3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch (1520-mm) centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

F. Sampling Holes:

1. Sampling holes of 5/64 inch (2 mm), or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
3. Each sampling point shall be identified by an applied decal.

2.14 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier products, provide products by one of the following:
1. Notifier.
2. Federal Signal Corporation.
3. GE UTC Fire & Security; A United Technologies Company.
4. Gentex Corporation.
5. Harrington Signal, Inc.
6. Keltron Corporation.
7. Mircom Technologies, Ltd.
8. Potter Electric Signal Company, LLC.
9. Siemens Industry, Inc.; Fire Safety Division.
10. SimplexGrinnell LP.
11. System Sensor.
12. Wheelock; a brand of Eaton.

B. General Requirements for Notification Appliances: System Sensors are to be red, Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

F. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

G. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

   a. 177 cd.
   b. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished white.

H. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: semi-recessed or surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

I. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.15 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:

1. Common-talk type for firefighter use only.

2. Selective-talk type for use by firefighters and fire wardens.
3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the fire-alarm control unit.
6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
7. Display: Graphic to indicate location of caller.
8. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.

    a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating “Fire Warden Phone" or "Fire Emergency Phone."
    b. With "break-glass" type door access lock.

9. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved “Fire Warden Phone" or "Fire Emergency Phone."
10. Handsets: push-to-talk-type sets stored in a cabinet adjacent to fire-alarm control unit.

2.16 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described in Section 230993.11 "Sequence of Operations for HVAC DDC."
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.17 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.18 GRAPHIC ANNUNCIATOR

A. Manufacturers: Subject to compliance with requirements, owner prefers to provide Notifier products, provide products by one of the following:
1. Notifier.
2. GE UTC Fire & Security; A United Technologies Company.
3. Harrington Signal, Inc.
4. Keltron Corporation.
5. Mircom Technologies, Ltd.
6. Potter Electric Signal Company, LLC.
7. Siemens Industry, Inc.; Fire Safety Division.
8. SimplexGrinnell LP.

B. Graphic Annunciator Panel: Mounted in an aluminum frame with non-glare, minimum 3/16-inch-(4.76-mm-) thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.

1. Comply with UL 864.
2. Operating voltage shall be 24-V dc provided by a local 24-V power supply provided with the annunciator.
3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and a lamp test switch.
4. Semi flush mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
5. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented by an LED in its actual location. CAD drawing shall be at 1/8-inch per foot (10-mm per meter) scale or larger.
6. The LED representing a detector shall flash two times per second while detector is an alarm.

C. Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system. PC with operating system software, minimum hard drive, digital display monitor, with wireless keyboard and mouse.

2.19 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

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

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.20 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and as required to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.21 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

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

2.22 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.

4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.23 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

C. Provide integration gateway using BACnet or Modbus for connection to building automation system.

2.24 SYSTEM PRINTER

A. Printer shall be listed and labeled as an integral part of fire-alarm system.

2.25 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

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

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

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

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

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

C. Equipment Mounting: Install fire-alarm control unit on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Install seismic bracing. Comply with requirements in Section 270548.16 "Seismic Controls for Communications Systems."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (460-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Equipment Mounting: Install fire-alarm control unit on finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

E. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

F. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.

3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

G. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B **in** NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

H. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

J. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

K. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

L. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

M. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

N. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

O. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

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

Q. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph (160-km/h) wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to elevator recall system and components.
7. Alarm-initiating connection to activate emergency lighting control.
8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
9. Supervisory connections at valve supervisory switches.
10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.
13. Data communication circuits for connection to mass notification system.
14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11

DAMPER SCHEDULE

SYMBOL	DESCRIPTION	OPTIONS & ACCESSORIES	MANUFACTURER & MODEL
MVD	MANUAL VOLUME DAMPER: RECTANGULAR, SINGLE BLADE, 22 GAUGE GALVANIZED STEEL BLADE, MOLDED SYNTHETIC BEARING	2" STAND OFF BRACK WITH HEAVY DUTY LOCKING QUADRANT (DURA-DYNE 8177)	RUSKIN MD25
RMVD	MANUAL VOLUME DAMPER: ROUND, SINGLE BLADE, 22 GAUGE GALVANIZED STELL BLADE, MOLDED SYNTHETIC BEARING	2" STAND OFF BRACKET WITH HEAVY DUTY LOCKING QUADRANT (DURA-DYNE 8177)	RUSKIN MDRS25
MD-1	MOTORIZED OPPOSED BLADE DAMPER: RECTANGULAR, OPPOSED BLADE, 16 GAUGE GALVANIZED STEEL BLADES, STAINLESS STEEL JAMB SEALS, VINYL ED...	2 POSTITION ACUTATOR; 120 VOLT, 1 PHASE	RUSKIN CD-36
FSD	FIRE SMOKE DAMPER: RECTANGULAR, 16 GAUGE SLEEVE, PARALLEL BLADE, STAINLESS STEEL JAMB SEALS, VINYL BLADE EDGE SEALS, STAINLESS STEEL BEARINGS, 1-1/2 HOUR, CLASS 1 LEAKAGE, UL 555 AND UL 555S...	120 VOLT, 1 PHASE ELECTRIC ACTUATOR ETL ELECTRIC RESET LINK (212 F) DUCT SMOKE DETECTOR ACCESS DOOR	RUSKIN FDS-37
HEF	HIGH EFFICIENCY FITTING: 24 FGAUGE GALVANIZED CONSTRUCTION, 18 GAUGE GALVANIZED STEEL BLADE, SOLID ROD, MOLDED SYNTHETIC BEARING, 1" FLANGE, EPDM RUBBER GASKET, INLET SIZE TO CONFORM TO SMACNA FIGURE 2-6 "BRANCH CONNECTIONS"	2" STAND OFF BRACKET WITH HEAVY DUTY LOCKING QUADRANT (DURA-DYNE 8177)	DUCTMATE SHTS15

ACCEPTABLE MANUFACTURERS: GREENHECK, RUSKIN, DUCTMATE 1

EXHAUST FAN SCHEDULE

ACCEPTABLE MANUFACTURERS:	CONTROLS:	REMARKS:	SCHEDULE KEY
PENN BARRY LOREN COOK TWIN CITY GREENHECK BROAN PANASONIC	(A) PROVIDE HUMIDSTAT AND PLACE IN CROWS NEST. CONFIRM FINAL LOCATION WITH BUILDING OWNERSHIP. (B) INTERLOCK WITH LIGHTS AND PROVIDE 10 MINUTE RUN DELAY.	(1) PROVIDE EC MOTOR VARIABLE SPEED FAN. (2) PROVIDE FACTORY AUTHORIZED STARTUP OF EQUIPMENT INCLUDING STARTUP OF ANY FACTORY CONTROLS TO ENSURE PROPER SEQUENCING AND/OR COMMUNICATION TO BMS. (3) PROVIDE DIE FORMED, GALVANIZED STEEL DRIVE FRAME ASSEMBLY AND PANEL, CAST ALUMINUM AIRFOIL BLADE PROPELLER WITH CORROSION RESISTANT FASTENERS, CONTROL-DIAL FOR BALANCING, GALVANIZED 45 DEG. WEATHERHOOD WITH BIRD SCREEN, DAMPER ACTUATOR (MP-310) 24 VAC, DAMPER MOUNTED (WD-320-PB-44X44) NOT COATED, & END SWITCH. (4) INSTALL FLUSH TO EXTERIOR. (5) COORDINATE EXACT LOCATION WITH STRUCTURAL ENGINEER TO AVOID X-BRACING.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	SERVES	TYPE	CFM	ESP (IN-WC)	FAN RPM	ELECTRICAL VOLTS	PHASE	Hz	HP	FLA	DISCONNECT PROVIDED BY (MECH/ ELEC)	CONTROL METHOD	SOUND RATING	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
EF-1	ARENA	WALL	23000	0.15	825	480	3	60	5	6.6	ELEC	A	82	573	GREENHECK	AER-42-VG	1,2,3,4,5
EF-2	RESTROOM	INLINE	150	0.2	1400	120	1	60	.1	1.3	ELEC	B	44	27	GREENHECK	SQ-70-VG	1,2

CEILING FAN SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:	SCHEDULE KEY
BIG ASS MICROAIR HUNTER INDUSTRIAL	(1) PROVIDE WITH REMOTE MOUNTED SPEED CONTROLLER. (2) COMPLY WITH AMCA 230, UL 507 SDA C22.2 NO. 113, NFPA 13, & NFPA 72. (3) COORDINATE WITH FIRE SPRINKLER CONTRACTOR TO ENSURE FAN IS APPROXIMATELY CENTERED BETWEEN FOUR ADJACENT SPRINKLERS. (4) THE VERTICAL CLEARANCE FROM THE HVLS FAN TO SPRINKLER DEFLECTOR SHALL BE A MINIMUM OF 3 FT. (5) ALL HVLS FANS SHALL BE INTERLOCKED TO SHUT DOWN IMMEDIATELY UPON RECEIVING A WATERFLOW SIGNAL FROM THE ALARM SYSTEM IN ACCORDANCE WITH THE REQUIREMENTS OF NFPA 72.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	SERVES	FOIL LENGTH	NO. BLADES	FAN RPM	MOUNTING HEIGHT (AFF)	ELECTRICAL VOLTS	PHASE	Hz	HP	FLA	DISCONNECT PROVIDED BY (MECH/ ELEC)	VFD PROVIDED BY (MECH/ ELEC)	SOUND RATING	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
CF-1	ARENA	24' - 0"	8	51	27' - 6"	480	3	60	2.0	10	ELEC			261	Big Ass Fans	Powerfoil 8	ALL

HEATER SCHEDULE (ELECTRIC)

ACCEPTABLE MANUFACTURERS:	REMARKS:	SCHEDULE KEY:
MODINE REZNOR QMARK MARLEY STERLING	(1) PROVIDE WITH BACNET CONTROLLER. (2) PROVIDE WITH FINGER PROOF FAN GUARD. (3) WALL MOUNT. (4) CEILING MOUNT. (5) PROVIDE WITH UNIT MOUNTED THERMOSTAT. (6) PROVIDE WITH SURFACE MOUNTING FRAME. (7) PROVIDE WITH MS26 CONTROLLER.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	TYPE	DIMENSIONS	MOUNTING HEIGHT	AIRFLOW (CFM)	HEATING CAPACITY (kW)	STAGES	ELECTRICAL VOLTS	PHASE	Hz	MCA	DISCONNECT PROVIDED BY (MECH/ ELEC)	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
H-1	CEILING	12" X 11" 4"	9' - 0"	50	0.5	1	120	1	60	4.7	ELEC	12	QMARK	QCH	1,2,4
H-2	WALL HEATER	8" X 5" X 17"	0' - 6"	50	0.75	1	120	1	60	6.3	ELEC	13	QMARK	GFR	1,2,3,5,6,7

LOUVER SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:
RUSKIN GREENHECK POTTORFF UNITED ENERTECH	(1) NC VALUES ARE BASED ON OCTAVE BAND SOUND POWER LEVELS MINUS A ROOM ABSORPTION OF 10 dB, RE 10(-12) WATTS. (2) COORDINATE EXACT COLOR SELECTION WITH OWNER AND ARCHITECT. (3) PROVIDE MOTORIZED DAMPER SIMILAR TO CORRESPONDING EF. INTERLOCK WITH EF-1. (4) COORDINATE EXACT LOCATION WITH STRUCTURAL ENGINEER TO AVOID X-BRACING.

LABEL	TYPE	SERVES	AIRFLOW (CFM)	PD (IN-WC)	NOMINAL SIZE	FREE AREA (SQ FT)	SCREEN TYPE	MANUFACTURER	MODEL	REMARKS
L-1	WALL LOUVER	ARENA	23,000	0.07	108" X 84"	31.10	BUG	GREENHECK	EAC-601	1,2,3,4

REGISTER - GRILLE- DIFFUSER SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:
KRUEGER TUTTLE & BAILEY TITUS PRICE	(1) PROVIDE TRANSITION AS NECESSARY. (2) COORDINATE EXACT COLOR SELECTION WITH OWNER AND ARCHITECT. (3) PROVIDE WITH LAY-IN TO HARD LID ADAPTER AS NECESSARY.

LABEL	TYPE	MAX AIRFLOW (CFM)	FACE SIZE	NECK SIZE	BLOW PATTERN	PD (IN-WC)	THROW(S) (FT)	MAX NC	MANUFACTURER	MODEL	REMARKS
E-1	45 DEGREE DEFLECTION	200	8" X 8"	6" Ø	N/A	0.020	N/A	30	PRICE INDUSTRIES	535	ALL

RADIANT TUBE HEATER SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:	SCHEDULE KEY:
MODINE REZNOR DETROIT RADIANT SCHWANK	(1) PROVIDE WITH DOUBLE WALL B-VENT AND VENT CAP. (2) PROVIDE TWO-STAGE CONTROLS.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	LENGTH	MOUNTING HEIGHT	HEATING CAPACITY (BTUH)	FLUE SIZE	FLUE TYPE	COMBUSTION AIR SIZE	COMBUSTION AIR TYPE	ELECTRICAL VOLTS	PHASE	Hz	MCA	DISCONNECT PROVIDED BY (MECH/ ELEC)	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
RTH	50' - 0"	15' - 0"	150,000	4"	STAINLESS STEEL	4"	STAINLESS STEEL	120	1	60	5	ELEC	239	SCHWANK	SPW2-155-50	ALL

HEAT PUMP SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:	SCHEDULE KEY
CARRIER YORK TRANE LENNOX DAIKIN	(1) PROVIDE WITH HAIL GUARDS. (2) PROVIDE WITH MIRO INDUSTRIES LD SUPPORT/MOUNTING FRAME. (3) PROVIDE WITH NEOPRENE PADS AT ALL MOUNTING CONNECTION POINTS. (4) PROVIDE REFRIGERANT PIPING SIZED AS PER MANUFACTURER'S RECOMMENDATIONS. "ACR" COPPER ONLY. (5) COORDINATE REFRIGERANT CHARGE AND PIPING SIZES WITH EQUIVALENT LINE LENGTH TO MINIMIZE PRESSURE DROP AND CAPACITY LOSS. (6) PROVIDE BOOT AT ANY CONDENSER LINE PENETRATIONS. (7) PROVIDE CRANKCASE HEATER. (8) INDOOR UNIT POWERED FROM OUTDOOR UNIT. (9) PROVIDE FACTORY AUTHORIZED STARTUP OF EQUIPMENT INCLUDING STARTUP OF ANY FACTORY CONTROLS TO ENSURE PROPER SEQUENCING AND/OR COMMUNICATION TO BMS.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	SERVES	OPERATING CONDITIONS	NOMINAL COOLING (BTUH)	SEER2	HEAT PUMP CAPACITY (BTUH)	HSPF2	REFRIGERANT TYPE	MAX TOTAL REFRIGERANT PIPE LENGTH (FT)	ELECTRICAL VOLTS	PHASE	Hz	MCA (EACH)	MOCP (EACH)	DISCONNECT PROVIDED BY (MECH/ ELEC)	SOUND RATING	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
ODU-1	IDU-1	98.3DB/62.6WB & 11.4DB	9,000	27.4	10,700	16.3	R-32	82	208	1	60	12	15	ELEC	42	97	DAIKIN	RXM09VVJU	ALL

DUCTLESS SPLIT SYSTEM INDOOR UNIT

ACCEPTABLE MANUFACTURERS:	REMARKS:	SCHEDULE KEY:
CARRIER YORK TRANE LENNOX DAIKIN	(1) INDOOR UNIT RECEIVES POWER FROM OUTDOOR UNIT THROUGH FIELD SUPPLIED WIRING. (2) RUN CONDENSATE DRAIN LINE TO NEAREST LAVATORY WYE PER IMC 307.2.1.1. (3) PROVIDE REFRIGERANT PIPING SIZED AS PER MANUFACTURER'S RECOMMENDATIONS. "ACR" COPPER ONLY. (4) COORDINATE REFRIGERANT CHARGE AND PIPING SIZES WITH EQUIVALENT LINE LENGTH TO MINIMIZE PRESSURE DROP AND CAPACITY LOSS. (5) PROVIDE FACTORY AUTHORIZED STARTUP OF EQUIPMENT INCLUDING STARTUP OF ANY FACTORY CONTROLS TO ENSURE PROPER SEQUENCING AND/OR COMMUNICATION TO BMS. (6) PROVIDE WITH 7-DAY PROGRAMMABLE THERMOSTAT.	PLUMB = DIVISION 22 MECH = DIVISION 23 ELEC = DIVISION 26 MNFR = MANUFACTURER

LABEL	TYPE	SERVES	AIRFLOW CFM	TOTAL COOLING CAPACITY (BTUH)	TOTAL HEATING CAPACITY (BTUH)	ELECTRICAL VOLTS	PHASE	Hz	DISCONNECT PROVIDED BY (MECH/ ELEC)	SOUND LEVEL	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
IDU-1	WALL MOUNT	ODU-1	350	9,000	10,700	208	1	60	ELEC	42	19.8	DAIKIN	FTXM09VVJU	ALL

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TYLER M. ANDERSON
04.17.25
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project:

USU BASTIAN AG CENTER - ARENA

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date: APRIL 17, 2025

revisions :

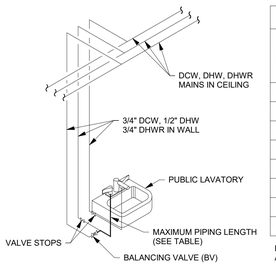
1 ADDENDUM #4 04.17.2025

title:

MECHANICAL SCHEDULES

sheet:

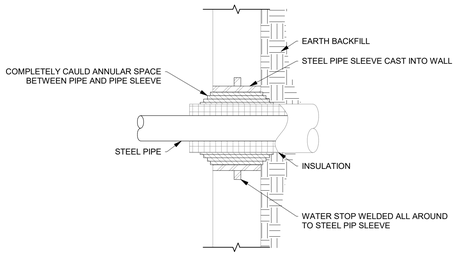
M003



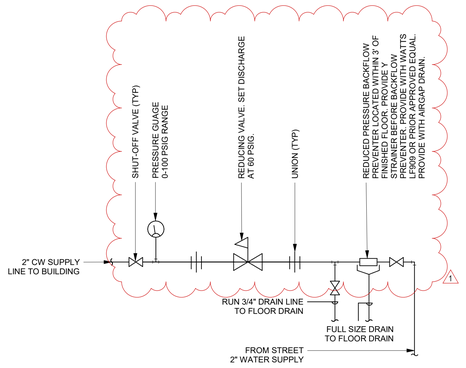
PIPING VOLUME AND MAXIMUM PIPING LENGTHS (IECC TABLE C404.5.1)			
NOMINAL PIPE SIZE (INCHES)	VOLUME (LIQUID OUNCES PER FOOT LENGTH)	MAXIMUM PIPING LENGTH (FEET)	
		PUBLIC LAVATORY FAUCETS	OTHER FIXTURES AND APPLIANCES
1/4	0.33	6	50
3/8	0.75	3	50
1/2	1.5	2	43
3/4	3	0.5	21
1	5	0.5	13
1 1/4	8	0.5	8
1 1/2	11	0.5	6
2 OR LARGER	18	0.5	4

BALANCING VALVE TO BE PROVIDED WITH TAMPER-PROOF ADJUSTMENT
ALL EXPOSED VALVES AND PIPING TO BE INSULATED

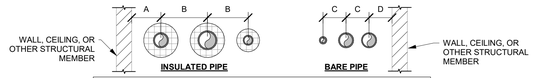
D1 PIPING VOLUME AND MAXIMUM PIPING LENGTHS
1/8" = 1'-0"



D3 TYPICAL INSULATED PIPE WALL PENETRATION
1/8" = 1'-0"

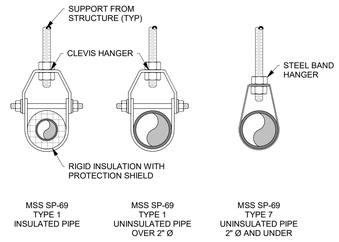


D4 PRV STATION DETAIL
1/8" = 1'-0"

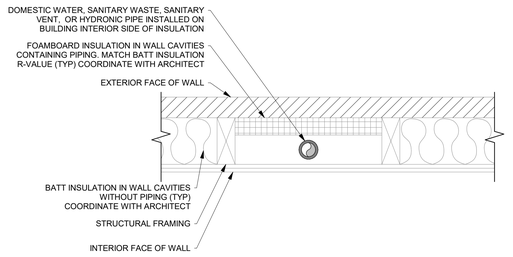


MINIMUM CENTERLINE SPACING				
NOMINAL PIPE SIZE	DIM A	DIM B	DIM C	DIM D
1/2" - 3/4"	5"	6"	3"	3 1/2"
1" - 1 1/2"	6"	8"	4"	4"
2" - 2 1/2"	7"	10"	5"	4 1/2"
3"	7 1/2"	11"	6"	5"
4"	8"	12"	7"	5 1/2"
5"	8 1/2"	13"	8"	6"
6"	9"	14"	9"	6 1/2"
8"	10"	16"	11"	7 1/2"

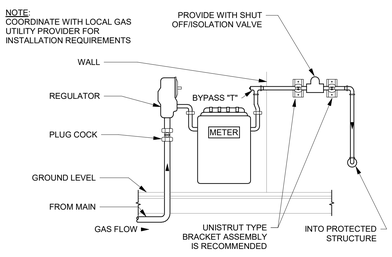
C1 PIPE CLEARANCES DETAIL
1/8" = 1'-0"



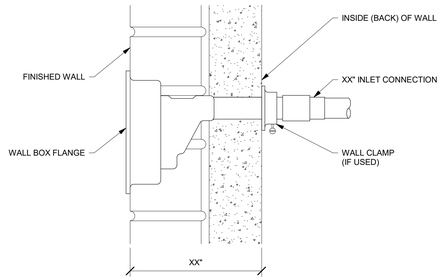
C2 PIPE HANGERS DETAIL
1/8" = 1'-0"



C4 PIPING IN EXTERIOR WALL DETAIL
1/8" = 1'-0"



B1 GAS METER DETAIL
1/8" = 1'-0"



B2 FREEZE-PROOF WALL HYDRANT DETAIL
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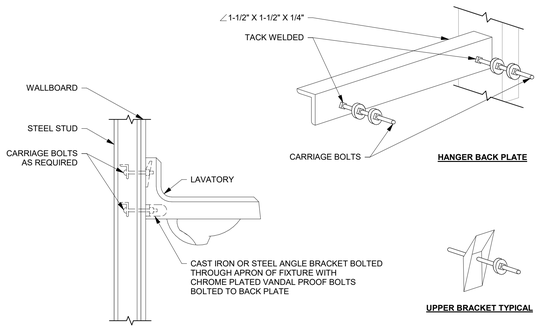
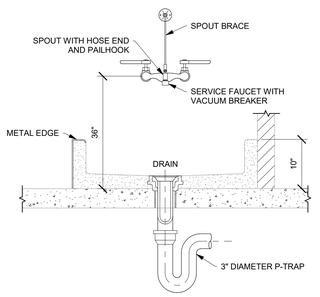
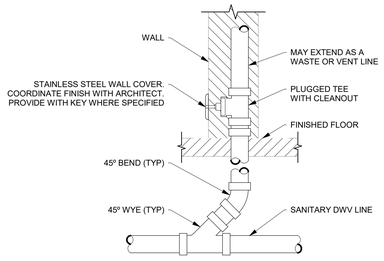


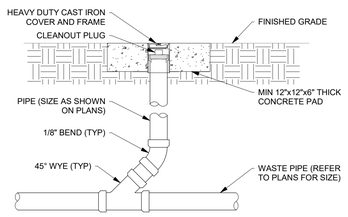
B3 LAVATORY MOUNTING FOR METAL STUDS
1/8" = 1'-0"



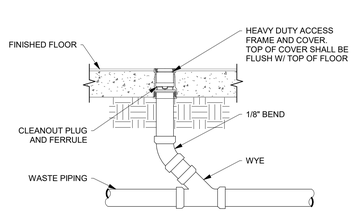
B5 MOP SINK DETAIL
1/8" = 1'-0"



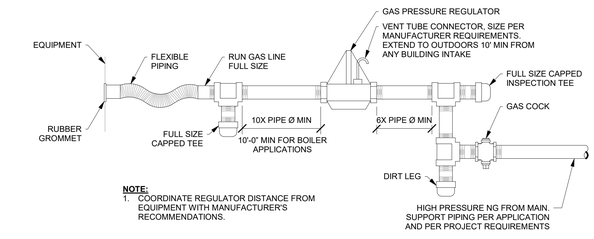
A1 CLEANOUT - WALL DETAIL
1/8" = 1'-0"



A2 CLEANOUT TO GRADE DETAIL
1/8" = 1'-0"



A3 FLOOR CLEANOUT DETAIL
1/8" = 1'-0"



A4 GAS PIPING REGULATOR
1/8" = 1'-0"

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PLUMBING DETAILS

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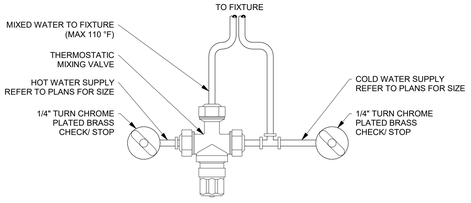
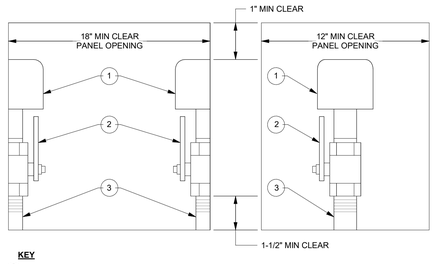
P002



B1 THERMOSTATIC MIXING VALVE (AT SINK) DETAIL
1/8" = 1'-0"

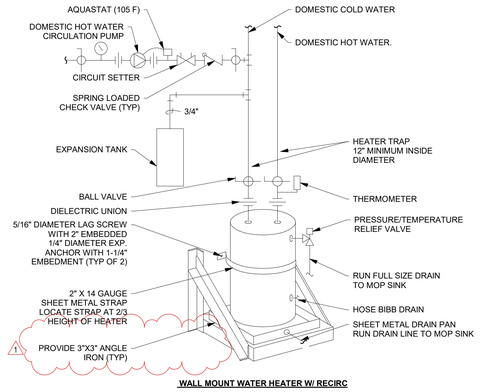


KEY

1. WATER HAMMER ARRESTOR
2. BALL VALVE, SAME NOMINAL SIZE AS PIPE BRANCH IN CHASE OPENING IN BALL VALVE TO MATCH PIPE I.D.
3. PIPE SAME SIZE AS BRANCH IN CHASE TO WHICH IT IS ATTACHED

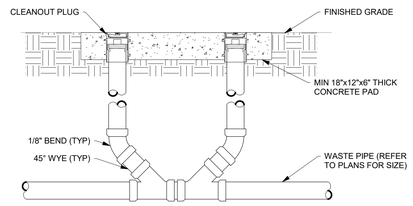
NOTE:
1. PROVIDE REDUCER IF REQUIRED BETWEEN VALVE AND WATER HAMMER ARRESTOR

B2 WATER HAMMER PANEL
1/8" = 1'-0"

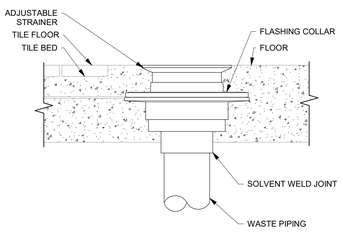


WALL MOUNT WATER HEATER W/ RECIRC

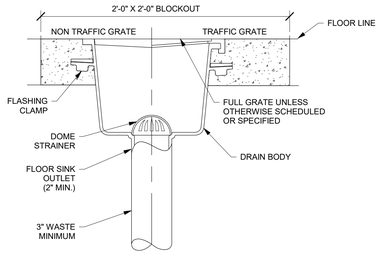
B3 WATER HEATER WALL MOUNTED WITH RECIRC
1/8" = 1'-0"



B5 CLEANOUT TO GRADE - TWO-WAY DETAIL
1/8" = 1'-0"

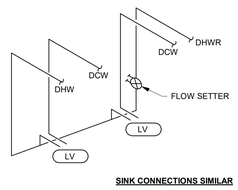


A1 FLOOR DRAIN
1/8" = 1'-0"



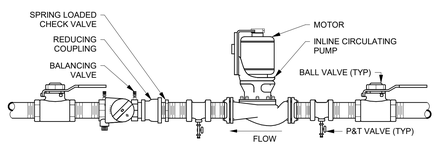
NOTE:
1. FLOOR SINKS ARE SHOWN FLUSH WITH FLOOR. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY, PRIOR TO INSTALLATION WITH THE LOCAL INSPECTOR AND THE LOCAL HEALTH DEPARTMENTIF THEY REQUIRE FLOOR SINKS TO BE RAISED. CONTRACT ARCHITECT/ ENGINEER PRIOR TO CHANGES

A2 FLOOR SINK DETAIL
1/8" = 1'-0"



SINK CONNECTIONS SIMILAR

A3 LAVATORY DOMESTIC WATER CONNECTION
1" = 1'-0"



A4 PUMP - INLINE DETAIL
1/8" = 1'-0"

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No. 13439797
TYLER M. ANDERSON
04.17.25
STATE OF UTAH

project:

USU BASTIAN AG CENTER - ARENA

[SET PROJECT INFORMATION ADDRESS TEXT FIELD AND SET LOCATION UNDER ENERGY SETTINGS IF APPLICABLE]

project #: 24.0170
date: APRIL 17, 2025

revisions :

1	ADDENDUM #4	04.17.2025

title:

PLUMBING DETAILS

sheet:

P003

SANITARY SEWER DEMAND

BASIS FOR DESIGN			
2021 INTERNATIONAL PLUMBING CODE - MINIMUM SLOPE = 1/8" PER FOOT			4"
CHAPTER 7 - SANITARY DRAINAGE- REQUIRED PIPE SIZE =			
TABLE 710.1(1) - BUILDING DRAINS AND SEWERS - 180 DFU'S PERMITTED ON MAIN			
EQUIPMENT	QUANTITY	INDIVIDUAL DRAINGE FIXTURE UNIT	TOTAL DRAINAGE FIXTURE UNITS
DRINKING FOUNTAIN	1	0.5	0.5
FLOOR DRAINS	2	2	4
FLOOR SINKS	1	2	2
LAVATORY	2	1	2
SERVICE SINK	1	2	2
WATER CLOSET, PUBLIC (1.6 GPF)	2	4	8
TOTAL	9		18.5

DOMESTIC HOT WATER DEMAND

2021 INTERNATIONAL PLUMBING CODE - TABLE E103.3(3) ESTIMATED DEMAND (GPM):	10.0
PIPE SIZE (WATER SUPPLY TO BUILDING):	1.0
2021 INTERNATIONAL PLUMBING CODE - FIGURE E103.3(5) PIPE FRICTION (PSI / 100 FT):	6.7
PIPE VELOCITY (FEET / SECOND):	3.9

EQUIPMENT	OCCUPANCY	TYPE OF SUPPLY CONTROL	QUANTITY	COMBINED WATER SUPPLY FIXTURE UNITS (WSFU)	TOTAL WATER SUPPLY FIXTURE UNITS (WSFU)
LAVATORY	PUBLIC	FAUCET	2	1.5	3
SERVICE SINK	OFFICES, ETC.	FAUCET	1	2.25	2.25
TOTAL			3		5.25

DOMESTIC COLD WATER DEMAND

2021 INTERNATIONAL PLUMBING CODE - TABLE E103.3(3) ESTIMATED DEMAND (GPM):	42.0
PIPE SIZE (WATER SUPPLY TO BUILDING):	2.0
2021 INTERNATIONAL PLUMBING CODE - FIGURE E103.3(5) PIPE FRICTION (PSI / 100 FT):	3.75
PIPE VELOCITY (FEET / SECOND):	4.5

EQUIPMENT	OCCUPANCY	TYPE OF SUPPLY CONTROL	QUANTITY	COMBINED WATER SUPPLY FIXTURE UNITS (WSFU)	TOTAL WATER SUPPLY FIXTURE UNITS (WSFU)
DRINKING FOUNTAIN	OFFICES, ETC.	3/8" VALVE	1	1	1
LAVATORY	PUBLIC	FAUCET	2	2	4
SERVICE SINK	OFFICES, ETC.	FAUCET	1	3	3
WATER CLOSET, PUBLIC (1.6 GPF)	PUBLIC	FLUSHOMETER VALVE	2	10	20
TOTAL			6		28

WATER HAMMER ARRESTER SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:
SIOUX CHIEF "HYDRA-ARRESTER" MIFAB "MWH" PPP "SC" WATTS LF02	(1) ANSI / ASSE 1010 LISTED (2) LEAD FREE CONSTRUCTION (3) COPPER TUBE BODY; POLY PISTON, EDPM O-RING (4) MIP THREADED INLET

SYMBOL	INLET SIZE (INCHES)	PDI SYMBOL	CAPACITY (DFU)	BASIS OF DESIGN MANUFACTURER & MODEL
WHA-A	1/2	A	1-11	SIOUX CHIEF 652-A
WHA-B	3/4	B	12-32	SIOUX CHIEF 653-B
WHA-C	1	C	22-60	SIOUX CHIEF 654-C
WHA-D	1	D	61-113	SIOUX CHEIF 655-D
WHA-E	1	E	114-154	SIOUX CHIEF 656-E
WHA-F	1	F	155-330	SIOUX CHIEF 657-F

OIL INTERCEPTOR CALCULATIONS	
SQUARE FOOTAGE	2400
FIRST 100 SQ.FT	6
REMAINING	23
TOTAL CUBIC FEET	29
CONVERSION TO GALLONS	216.92
CALCULATIONS PER IPC 1003.4.2.2	

PLUMBING FIXTURE SCHEDULE

REFER TO PLUMBING SPECIFICATIONS FOR COMPLETE FIXTURE COMPONENTS

ACCEPTABLE MANUFACTURERS: ZURN, WATTS, JAY R. SMITH, OASIS, GLOBAL INDUSTRIAL, AMERICAN STANDARD. 1

LABEL	DESCRIPTION	WASTE	VENT	CW	HW	MANUFACTURER	MODEL	REMARKS
COTG	CLEANOUT TO GRADE	0"	0"	0"	0"	ZURN	Z1400 SERIES	SIZE TO MATCH PIPE BEING SERVED
EWC	BI-LEVEL ELECTRIC WATER COOLER WITH BOTTLER FILLING STATION	1 1/2"	1 1/2"	1/2"	0"	ELKAY	LZSTL8WSLP	ELECTRICAL DATA: 120/1, 4 FLA, 370 WATTS
FCO	FLOOR CLEANOUT	0"	0"	0"	0"	ZURN	Z1400 SERIES	SIZE TO MATCH PIPE BEING SERVED
FD	FLOOR DRAIN	2"	2"	0"	0"	FIXTURE: ZURN TRAP SEAL: RECTORSEAL	FIXTURE: Z415-BZ1 TRAP SEAL: SURESEAL	TRAP SEAL TO MATCH FD SIZE
FS	FLOOR SINK	3"	2"	0"	0"	ZURN	Z1900	PROVIDE FULL GRATE
HB-1	HOSE BIBB	0"	0"	3/4"	0"	CHICAGO	293CP	PROVIDE NON-FREEZE KEY OPERATED WITH INTEGRAL VACUUM BREAKER, AND LOOSE KEY
HB-2	HOSE BIBB	0"	0"	3/4"	0"	WATTS	HY-440	PROVIDE WITH ANTI-SIPHON, CHROME PLATED FACE, INTEGRAL VACUUM BREAKER, AND LOOSE KEY.
LAV-A	WALL MOUNTED LAVATORY (ACCESSIBLE)	1 1/4"	1 1/2"	1/2"	1/2"	FIXTURE: KOHLER FAUCET: KOHLER INSULATION: TRUEBRO TMV: WEBSTONE	FIXTURE: K-2035-1 FAUCET: K-13461 INSULATION: LAVGUARD 2 TMV: H-77211W-TG	MOUNT AT ADA HEIGHT SET TMV AT 110 DEG. F.
MOP	SERVICE SINK	3"	2"	3/4"	3/4"	FIXTURE: MUSTEE FAUCET:KOHLER	FIXTURE: 63M FAUCET: K-8907	PROVIDE HOSE AND HOSE HOLDER, MOP HANGER, BUMPER AND WALL GUARDS
RPZ	REDUCED PRESSURE ZONE VALVE ASSEMBLY	0"	0"	2"	0"	WATTS	LF009 SERIES	
TD-1	TRENCH DRAIN	4"	0"	0"	0"	WATTS	DEAD LEVEL D: D-152-CO-RSS-FS	
WC-A	FLOOR MOUNT FLUSH VALVE WATER CLOSET (ACCESSIBLE)	3"	2"	1 1/2"	0"	FIXTURE: KOHLER FLUSH VALVE: ZURN SEAT: BEMIS	FIXTURE: K-96057-SSL FLUSH VALVE: ZER6000-CP-WS1 SEAT: 1955CTJ	
WCO	WALL CLEANOUT	0"	0"	0"	0"	ZURN	Z1446	SIZE TO MATCH PIPE BEING SERVED

NATURAL GAS REQUIREMENTS

EQUIPMENT	QUANTITY	SEA LEVEL FUEL GAS INPUT CAPACITY (BTUH)	JOB SITE FUEL GAS REQUIREMENTS (CFH)	TOTAL FUEL GAS CAPACITY (CFH)	BRANCH PIPE SIZES (INCHES)	
					2 PSIG	0.5 PSIG
RTH-1	8	150000	163	919		X
BASIS OF DESIGN			NOTES:			
2021 INTERNATIONAL FUEL GAS CODE						
Image						

PIPE INSULATION REQUIREMENTS

SERVICE	PIPE SIZE	PIPE INSULATION MATERIAL
DOMESTIC COLD WATER	ALL	1" PREFORMED FIBERGLASS WITH ALL SERVICE JACKET PREFORMED PVC FITTING COVERS
DOMESTIC HOT WATER		

RECIRCULATION PUMP SCHEDULE

ACCEPTABLE MANUFACTURERS:	REMARKS:
BELL & GOSSETT ARMSTRONG TACO GRUNDFOS	(1) PROVIDE WITH AQUASTAT AND TIE INTO BUILDING TIMER WITH RUN TIME 1 HOUR BEFORE AND AFTER OCCUPIED SCHEDULE. (2) BALANCE DOMESTIC HOT WATER RECIRCULATING LINE. PROVIDE BALANCING VALVE. PROVIDE P&T PORT ON INLET AND DISCHARGE OF PUMP. PROVIDE BALANCE REPORT TO ENGINEER. (3) PROVIDE WITH BRONZE, PLASTIC, OR STAINLESS STEEL IMPELLER AND STAINLESS STEEL BODY. (4) RUN IN CONSTANT PRESSURE MODE IN CONJUNCTION WITH CALEFFI MODEL 116 THERMAL BALANCING VALVES TO ALLOW PUMP TO RUN AT LOWER SPEED WHEN HOT WATER IS RUNNING. (5) PROVIDE CALEFFI THERMAL BALANCING VALVE SET TO 110 F AT EACH CONNECTION POINT OF RECIRC LINE TO HOT WATER LINE.

	FLUID				ELECTRICAL								
LABEL	LIQUID TYPE	GPM	HEAD (FT)	MAX. TEMP. (°F)	VOLTS	PHASE	Hz	WATTS	HP	AMPS	MANUFACTURER	MODEL	REMARKS
RCP-1	WATER	1	10.00	110	120	1	60	.125	-----	-----	BELL & GOSSETT	NBF-25	ALL

WATER HEATER (ELECTRIC)

ACCEPTABLE MANUFACTURERS:	REMARKS:
LOCHINVAR AO SMITH BRADFORD WHITE RHEEM	(1) PROVIDE WITH EXPANSION TANK THERM-X-TROL ST-12. (2) WATER HEATER ON PLATFORM ABOVE. ROUTE RELIEF VALVE PIPING TO MOP SINK BELOW. (3) PROVIDE WITH UPPER AND LOWER SEISMIC STRAPS WITH TWO 5/16" LAG SCREWS HAVING 2" OF EMBED AT EACH CONNECTION LOCATION. (4) ROUTE DRAIN TO FLOOR DRAIN.

					ELECTRICAL								
LABEL	LOCATION	TYPE	TANK SIZE (GAL)	RECOVERY GPH @ 90° ΔT	VOLTS	PHASE	Hz	kW	AMPS	OPERATING WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
WH	ABOVE MOP SINK	TANK	19	21	208	3	50	5.0	14	222	Bradford White	LE120U3-1	ALL

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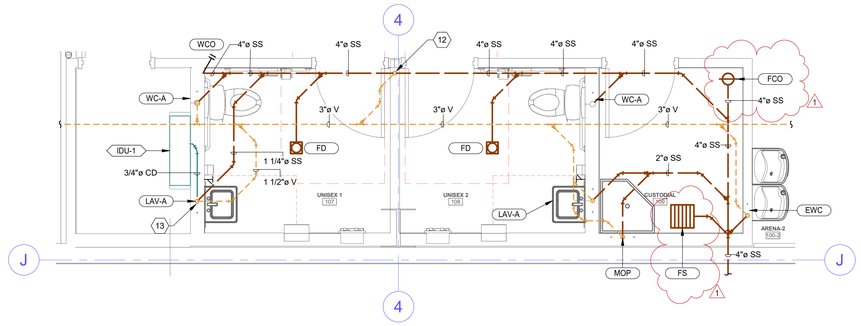
title:

PLUMBING SCHEDULES

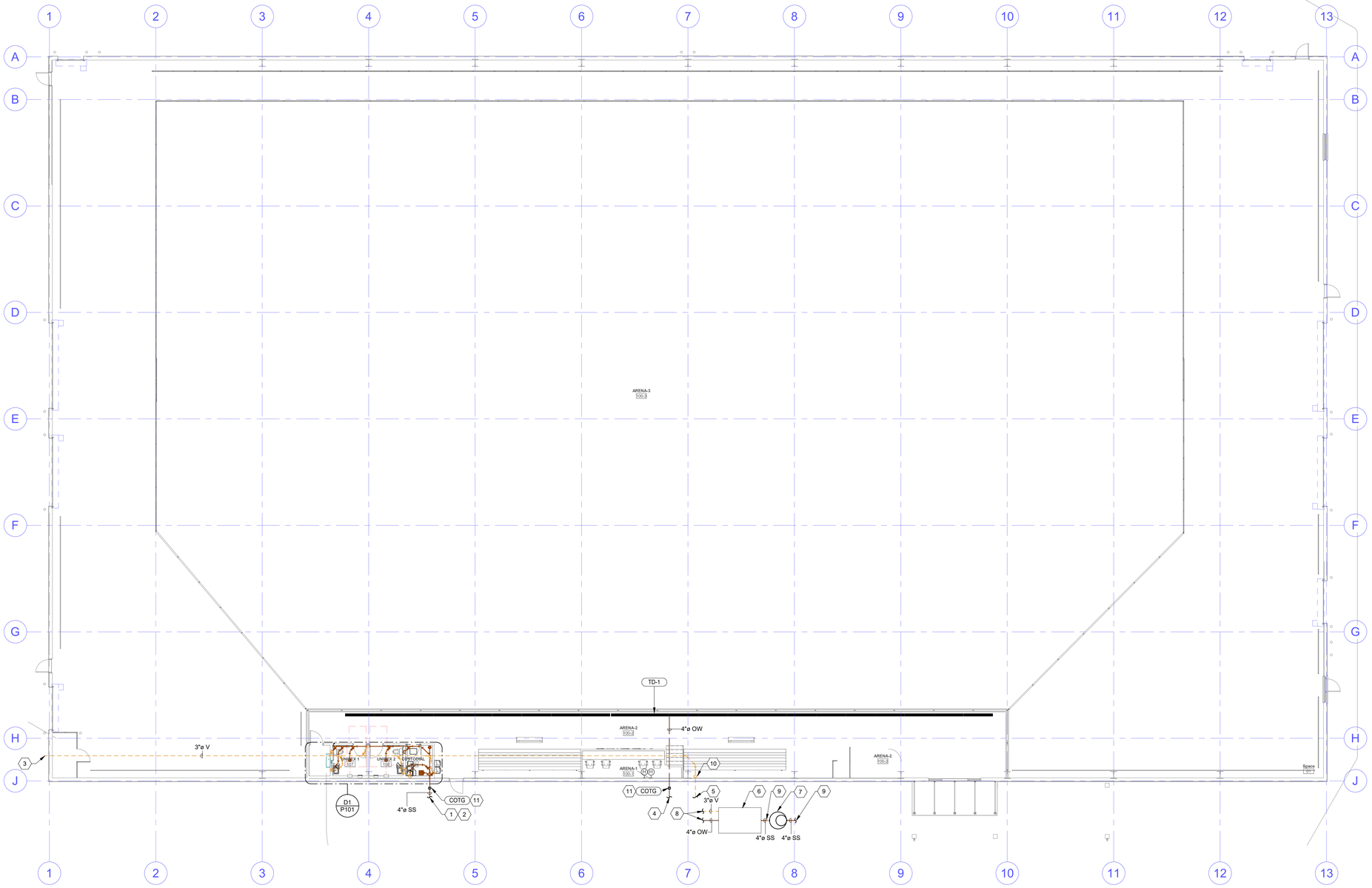
sheet:

P004



D1 RESTROOMS & JANITOR ROOM - DWV

3/8" = 1'-0" (REF: A1/P101)



A1 LEVEL 1 PLUMBING PLAN - DWV

3/32" = 1'-0"

PLUMBING GENERAL NOTES

1. THE PLUMBING DRAWINGS SHOW THE GENERAL DESIGN, ARRANGEMENT AND EXTENT OF THE PLUMBING SYSTEM. BECAUSE OF THE SMALL SCALE OF THE DRAWINGS, THESE DRAWINGS DO NOT SHOW ALL OFFSETS, BENDS OR ELBOWS NECESSARY FOR THE COMPLETE INSTALLATION IN THE SPACE PROVIDED. CONTRACTOR SHALL MAKE SUCH SLIGHT ALTERATIONS AS MAY BE NECESSARY TO MAKE THE SYSTEM COMPLETE AND OPERATIONAL IN ACCORDANCE WITH THE DESIGN INTENT. MAJOR DEVIATIONS SUCH AS CHANGES IN COMPONENT SIZES, WEIGHTS, QUANTITIES OR MATERIAL REQUIRE PRIOR APPROVAL BY THE DESIGN ENGINEER.
2. THE DRAWINGS AND SPECIFICATIONS HAVE BEEN PREPARED TO SUPPLEMENT EACH OTHER AND SHALL BE INTERPRETED AS AN INTEGRAL UNIT WITH THE ITEMS SHOWN ON ONE AND NOT THE OTHER BEING FURNISHED AND INSTALLED AS THOUGH SHOWN AND CALLED OUT IN BOTH.
3. THE ENTIRE PLUMBING INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE MOST RECENTLY ADOPTED BUILDING CODES, MECHANICAL CODE, PLUMBING CODE, ELECTRICAL CODE, AND ALL OTHER APPLICABLE CITY, COUNTY, STATE, AND FEDERAL CODES AND REGULATIONS IN EFFECT.
4. THE ENTIRE PLUMBING INSTALLATION SHALL CONFORM TO ANY CODES, RULES, REGULATIONS AND REQUIREMENTS OF THE BUILDING OWNER.
5. PRIOR TO FABRICATION AND INSTALLATION OF ANY PLUMBING COMPONENT THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL PLUMBING WORK WITH ALL OTHER BUILDING TRADES, INCLUDING BUILDING TRADES HIRED DIRECTLY BY THE OWNER. WHERE CONFLICTS MAY OCCUR, THEY SHALL BE RESOLVED PRIOR TO INSTALLATION.
6. ALL PLUMBING INFORMATION IS NOT SHOWN ON THE PLUMBING DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL INFORMATION ON ALL OTHER CONSTRUCTION DOCUMENTS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE TO REVIEW AND USE, WHERE APPROPRIATE, ALL THE PLUMBING DETAILS SHOWN ON THE DRAWINGS. DETAILS MAY OR MAY NOT BE CALLED OUT ON THE DRAWINGS WITH SYMBOLS OR KEYED NOTES. ANY CHANGES RESULTING FROM FAILURE TO INSTALL THE PLUMBING SYSTEM WITHOUT USING THE INCLUDED DETAILS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
8. ANY PART OF THE PLUMBING INSTALLATION THAT FAILS, IS UNFIT, OR BECOMES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
9. PROVIDE PROPER PROVISIONS FOR EXPANSION, CONTRACTION, OR MOVEMENT OF ALL PIPING.
10. PROVIDE LARGE ENOUGH PIPE SLEEVES THROUGH WALL OR FLOOR TO ALLOW FOR ANTICIPATED DIFFERENTIAL MOVEMENT.
11. ALL PIPING SHALL BE SUPPORT WITH CLEVIS HANGERS (MSS TYPE 1). PERFORATED METAL STRAPS OR PLASTIC STRAPPING (PLUMBER TAPE) SHALL NOT BE USED TO SUPPORT OR BRACE ANY PIPE.
12. PROVIDE PIPE HANGERS WITHIN 18-INCHES OF ALL CHANGES OF DIRECTION.
13. PROVIDE SWAY BRACING FOR ALL PIPING 4" AND LARGER AT ALL CHANGES IN DIRECTION GREATER THAN 45-DEGREES.
14. ALL STEEL CLEVIS HANGERS USED TO SUPPORT COPPER PIPING SHALL BE COPPER OR PLASTIC COATED.
15. COPPER PIPING SHALL NOT COME IN CONTACT WITH FIRE TREATED LUMBER. PROVIDE ½" THICK SLIP-ON CLOSED CELL INSULATION WHERE COPPER PIPING IS ADJACENT TO FIRE TREATED LUMBER. CLOSED CELL INSULATION SHALL EXTEND A MINIMUM OF 1-1/2" PAST LUMBER.
16. ALL EXPOSED PIPING SHALL BE INSTALLED IN A NEATLY ARRANGED MANNER PARALLEL TO THE BUILDING STRUCTURE.
17. ALL EXPOSED DOMESTIC WATER PIPE IN OCCUPIED SPACES SHALL BE POLISHED CHROME PLATED.
18. ALL EXPOSED DRAINAGE PIPING IN OCCUPIED SPACES INCLUDING TRAPS UNDER SINKS SHALL BE POLISHED CHROME PLATED.
19. DRAWINGS SHOW GENERAL ARRANGEMENT OF THE DRAIN WASTE AND VENT SYSTEM WITH THE REQUIRED CLEANOUTS. CONTRACTOR SHALL PROVIDE ALL ADDITIONAL CLEANOUTS AS REQUIRED BY THE PLUMBING CODE.
20. ALL SANITARY DRAINAGE SYSTEM PIPING 3" AND LARGER SHALL BE SLOPED IN DIRECTION OF FLOW AT A MINIMUM OF 1/8" PER FOOT.
21. ALL SANITARY DRAINAGE SYSTEM PIPING SMALLER THAN 3" SHALL BE SLOPED IN DIRECTION OF FLOW AT A MINIMUM OF 1/4" PER FOOT.
22. SLOPE VENT SYSTEM TOWARDS DRAINAGE SYSTEM.
23. SIMILAR EQUIPMENT SHALL BE OF THE SAME MANUFACTURER.
24. ALL EQUIPMENT SHALL PROVIDE THE SCHEDULED PERFORMANCE AT THE JOB SITE ELEVATION.
25. FIXTURE AND EQUIPMENT MODEL NUMBERS SHOWN IN PLUMBING FIXTURE SCHEDULE AND PLUMBING EQUIPMENT SCHEDULE ARE SHOWN TO ESTABLISH THE TYPE OF PRODUCT THAT SHALL BE USED. THE SELECTED PRODUCT SHALL MEET THE SCHEDULED PERFORMANCE DATA SHOWN ON THE SCHEDULE EVEN IF A DIFFERENT MODEL IS SUPPLIED THAT IS DIFFERENT THAN THAT SCHEDULED.
26. ALL EQUIPMENT SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS. PROVIDE ALL NECESSARY FITTINGS, TRANSITIONS, VALVES AND OTHER DEVICES AND ACCESSORIES REQUIRED FOR A COMPLETE, WORKABLE INSTALLATION.
27. SEE "PLUMBING FIXTURE SCHEDULE" FOR INDIVIDUAL TRAPS, WASTE, VENT, AND DOMESTIC WATER PIPING FOR INDIVIDUAL FIXTURES.
28. ALL PLUMBING EQUIPMENT SHALL BE LISTED AND LABELED BY AN APPROVED TESTING AGENCY.
29. FIXTURES, EQUIPMENT AND PIPING INSTALLATION SHALL MEET NSF STANDARDS.

SHEET KEYNOTES

1	4" SS. SEE CIVIL SITE PLAN FOR CONTINUATION.
2	DCW AND SS SHALL BE INSTALLED IN SAME TRENCH. BUILDING SEWER SHALL BE CONSTRUCTED IN ACCORDANCE WITH IPC TABLE 702.2. SEE SPECIFICATIONS FOR EXACT MATERIAL REQUIREMENTS.
3	3" VENT THRU WALL. INSTALL WITHIN 1' FROM ROOF. VENT SHALL EXTEND 12 INCHES FROM THE WALL WITH AN ELBOW POINTING DOWNWARDS AS PER IPC 903.7
4	4" OW. SEE CIVIL SITE PLAN FOR CONTINUATION.
5	3" VENT. SEE CIVIL SITE PLAN FOR CONTINUATION.
6	450 GALLON OIL INTERCEPTOR. CONFIRM SIZE WITH CIVIL ENGINEER. SEE CIVIL SITE PLAN FOR EXACT LOCATION.
7	SAMPLING MANHOLE. SEE CIVIL SITE PLAN FOR CONTINUATION.
8	4" OW & 3" V. SEE CIVIL SITE PLAN FOR CONTINUATION.
9	4" SS. SEE CIVIL SITE PLAN FOR CONTINUATION.
10	ROUTE 3" VENT EXPOSED ON INTERIOR OF STRUCTURE.
11	PROVIDE TWO-WAY CLEANOUT. INVERT ELEVATION @ 30" BELOW FINISHED FLOOR.
12	2" VENT DN WALL TO 4" SS.
13	ROUTE CONDENSATE LINE TO LAVATORY WYE

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1	ADDENDUM #4	04.17.2025

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LEVEL 1 PLUMBING PLAN - DWV

sheet:

P101

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MEP Addendum #5

Date:	April 21, 2025		
To:	Kelly Morgan	**From:**	Tyler Anderson
Company:	Method Studio	**Email:**	Tyler.anderson@speceng.com
Job:	USU Bastian Center	**Phone:**	801.328.5151
Job No:	240226	**Re:**	
Cc:			

This Addendum shall be considered part of the Contract Documents and Project Manual for the above mentioned project as though it had been issued at the same time and shall be incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original Contract Documents and Project Manual, the Addendum shall govern and take precedence.

Plumbing Addendum

Specifications

1. 231123 – FACILITY NATURAL-GAS PIPING
    a. Revised all specifications that indicate aboveground natural gas piping to be schedule 40 with threaded fitting for piping 2” and smaller to match USU standards.
        i. Please note that no piping over 2” is included with design so the comment from the USU team for welded fittings was not included.

Electrical Addendum

Drawings

1. FA601:
    a. Update General Note 7 to say 48 hours instead of 24 hours.
    b. Add general note 19.

END OF ADDENDUM

Attachments FA601

WIRING SCHEDULE

FUNCTION	< 500'	< 1000'	1000'-3000'	> 3000'
ADDRESSABLE LOOP	#18 TSP	#18 TSP	#16 TSP	#14 TSP
POWER LOOP	#14 THWN	#14 THWN	#12 THWN	#10 THWN
SPARE LOOP	#14 THWN	#14 THWN	#12 THWN	#10 THWN
STROBE HORNS	#14 THWN	#14 THWN	#12 THWN	#10 THWN
MAGNETIC DOOR HOLDER	#12 THWN	#10 THWN		
SPEAKERS	#16 TSP	#16 TSP	#14 TSP	#14 TSP

NOTIFICATION SCHEDULE

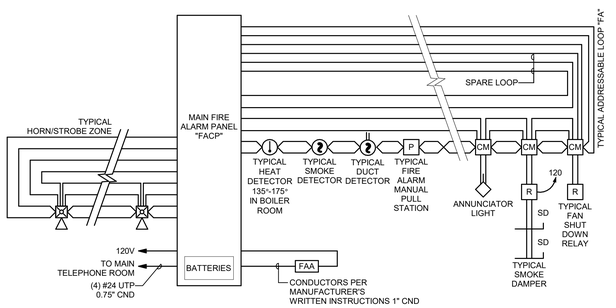
SYMBOL	STROBE SIZE	COVERAGE	AVERAGE CURRENT	MAXIMUM PER CIRCUIT ALONE
15	15 CD	20'x20'	.085A	17
30	30 CD	30'x30'	.135A	11
75	75 CD	40'x40'	.200A	7
110	110 CD	50'x50'	.225A	6

NOTIFICATION SCHEDULE

SYMBOL	STROBE SIZE	COVERAGE	AVERAGE CURRENT	MAXIMUM PER CIRCUIT ALONE
15	15 CD	20'x20'	.060A	25
30	30 CD	30'x30'	.083A	18
75	75 CD	40'x40'	.136A	11
110	110 CD	50'x50'	.179A	8
135	135 CD	60'x60'	.225A	4

FIRE ALARM INPUT/OUTPUT MATRIX

INITIATING DEVICES ZONE		OUTPUT DEVICES: GENERAL ALARM	DOOR HOLDER/CLOSERS	ELEVATOR RECALL MAIN LEVEL	ELEVATOR RECALL ALTERNATE LEVEL	FAN SHUTDOWN	FIRE DAMPER	MAIN LEVEL ELEVATOR DOORS HOLD OPENS	2ND LEVEL ELEVATOR DOORS HOLD OPENS	3RD LEVEL ELEVATOR DOORS HOLD OPENS	4TH LEVEL ELEVATOR DOORS HOLD OPENS	5TH LEVEL ELEVATOR DOORS HOLD OPENS	ELEVATOR SHUNT TRIP					NOTES
1	MAIN FLOW	o																
2	MAIN TAMPER																	
3	MAIN LEVEL FLOW																	
4	MAIN LEVEL TAMPER																	
5	MAIN LEVEL DUCT DETECTOR																	
6	FIRE PUMP RUNNING																	
7	FIRE PUMP LOSS OF POWER																	
8	FIRE PUMP PHASE REVERSAL																	



A1 FIRE ALARM RISER
SCALE: NTS

GENERAL SHEET NOTES

1 PLANS ARE BASED UPON 99 MONITOR AND CONTROL DEVICES PER ADDRESSABLE LOOP. OTHER CONFIGURATIONS ARE ACCEPTABLE SUBJECT TO CONTRACTOR ALLOWING FOR INCREASED WIRING REQUIREMENTS AND SUBMITTAL DRAWINGS SHOWING NEW WIRING CONFIGURATION. MAXIMUM INITIAL DEVICES PER LOOP SHALL NOT EXCEED 75% MAXIMUM ALLOWABLE.

2 PLANS ARE BASED UPON THE WIRING SCHEDULE SHOWN. WHERE MANUFACTURER'S REQUIREMENTS EXCEED REQUIREMENTS SHOWN, INCLUDE ADDITIONAL ASSOCIATED COSTS AND SUBMITTAL DRAWINGS INDICATING NEW WIRING CONFIGURATION.

3 PLANS ARE BASED UPON 2 AMPS AT 24 VDC, NOT TO EXCEED 75% (1.50 AMPS AVAILABLE), POWER SUPPLY CAPACITY PER NOTIFICATION CIRCUIT. NOTIFICATION DEVICE LOADS ARE BASED UPON NOTIFICATION DEVICE SCHEDULE SHOWN. INCLUDE ADDITIONAL ASSOCIATED COSTS FOR INCREASED WIRING AND POWER SUPPLY CAPACITY IF LOADS OF ACTUAL DEVICES PROVIDED EXCEED CIRCUIT CAPACITY, OR IF LOAD OUTPUT OF ACTUAL POWER SUPPLIES PROVIDED IS SIZED DIFFERENTLY. PROVIDE SUBMITTAL DRAWINGS SHOWING NEW WIRING CONFIGURATION.

4 FLOW AND TAMPER CONFIGURATION BASED UPON FIRE SPRINKLER DESIGN CONCEPT. FIELD VERIFY ACTUAL REQUIREMENTS. INCLUDE ANY ADDITIONAL MONITOR MODULES REQUIRED BY ACTUAL DESIGN REQUIREMENTS.

5 HEAT DETECTORS WHEN INSTALLED IN ELEVATOR SHAFTS OR MECHANICAL ROOMS FOR ELEVATOR SHUT DOWN SHALL HAVE HEAT DETECTOR WITH LOWER RESPONSE TIME INDEX THAN SPRINKLER HEAD.

6 PROVIDE POWER SUPPLY CAPACITY AS REQUIRED FOR DOOR HOLD OPENS SHOWN.

7 BATTERY CAPACITY TO BE ADEQUATE TO OPERATE 15 MINUTES AFTER 48 HOURS PLUS 25% SPARE CAPACITY. 2

8 VFD REQUIRES TWO RELAYS, ONE FOR SMOKE CONTROL, ONE SPARE.

9 RUN SPARE LOOPS IN SAME CONDUIT. DO NOT EXCEED 40% AREA FILL OF CONDUITS.

10 PROVIDE DUCT DETECTORS FOR SUPPLY AND RETURN AIR SYSTEMS OVER 2000 CFM. INSTALL DUCT DETECTORS PER NFPA 72 REQUIREMENTS AND PROVIDE ADDITIONAL DUCT DETECTORS DEPENDING UPON FINAL DUCT ARRANGEMENT.

11 PROVIDE DUCT DETECTOR AT EACH FLOOR, PRIOR TO CONNECTION TO A COMMON RETURN AND PRIOR TO RECIRCULATING OR FRESH AIR INLET IN AIR RETURN SYSTEMS OVER 15,000 CFM CAPACITY AND SERVING MORE THAN ONE STORY.

12 PROVIDE MANUAL PULL STATIONS IN BOILER ROOMS AND KITCHENS.

13 PROVIDE ONE YEAR OFF SITE MONITORING INCLUDING ALL INTERFACE DEVICES AND MONITORING CHARGES. COORDINATE WITH BUILDING OWNER'S OFF SITE MONITORING COMPANY.

14 LOCATE SMOKE DETECTORS MINIMUM 3' FROM AIR SUPPLY AND RETURN LOUVERS.

15 PROVIDE SYNCHRONIZED STROBES THROUGHOUT FACILITY. PROVIDE SYNCHRONIZATION MODULES PER MANUFACTURER'S REQUIREMENTS. INCLUDE ADDITIONAL WIRING, IF REQUIRED.

16 INITIATING AND INDICATING LOOPS SHALL NOT SERVE AN AREA OF GREATER THAN 22,500 SQUARE FEET. PROVIDE ADDITIONAL LOOPS FOR AREAS LARGER THAN THIS.

17 ALL OUTPUT DEVICES ARE DESIGNED ON SYSTEMS WITH 2 AMP POWER SUPPLY.

18 HORN/STROBE BASED ON 120 MILLIAMPS, DOOR HOLDERS BASED ON 70 MILLIAMPS.

19 FIRE ALARM SYSTEM TO BE INSTALLED AS REQUIRED BY DFCM ELECTRICAL DESIGN REQUIREMENTS. 1

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project:

USU BASTIAN CENTER

[SET PROJECT INFORMATION ADDRESS TEXT FIELD AND SET LOCATION UNDER ENERGY SETTINGS IF APPLICABLE]

project#: 24.0170
date: JANUARY 31, 2025

revisions :

2	ADD#05	04.21.2025

title:

FIRE ALARM RISER DIAGRAMS

sheet:

FA601

CD SET

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Manual gas shutoff valves.
3. Pressure regulators.
4. Service meters.
5. Dielectric fittings.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. An example includes rooftop locations.

C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Piping specialties.
2. Corrugated, stainless steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings.
6. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 3/32” inch per foot.
2. Detail mounting, supports, and valve arrangements for service-meter assembly and pressure regulator assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Welding certificates.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Field quality-control reports.

E. Qualification Statements: For professional engineer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping in accordance with requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed and concealed behind finished surfaces.

C. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 220553 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each product type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with **the** International Fuel Gas Code.

B. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 2 psig.

C. Natural-Gas System Pressure within Buildings:

1. Single Pressure: More than 0.5 psig, but not more than 2 psig.

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

E. Seismic Performance: Natural-gas piping system is to withstand the effects of earthquake motions. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. The term "withstand" means "the piping system will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

2. Component Importance Factor: 1.0.

2.3 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiralwound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

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

        1) Baker Hughes Company
        2) Smith-Blair, a Xylem brand

    b. Stainless steel flanges and tube with epoxy finish.
    c. NBR seals.
    d. Steel bolts, washers, and nuts.
    e. Coupling is to be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    f. Steel body couplings installed underground on plastic pipe are to be factory equipped with anode.

2.4 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Corrugated, stainless steel tubing with polymer coating.
3. Operating-Pressure Rating: 0.5 psig.
4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Seals: Nitrile.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap:

1. Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.5 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.6 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 150 psig.
2. Threaded Ends: Comply with ASME B1.20.1.

3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves NPS 1-1/4 to NPS 2 having initials "WOG" permanently marked on valve body.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

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

    a. A.Y. McDonald Mfg. Co.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems
    c. BrassCraft Manufacturing Co.; a Masco company
    d. Perfection Corporation
    e. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated

2. Body: Bronze, complying with ASTM B584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
8. CWP Rating: 150 psig.
9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

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

    a. A.Y. McDonald Mfg. Co.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems
    c. BrassCraft Manufacturing Co.; a Masco company
    d. Perfection Corporation
    e. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated

2. Body: Bronze, complying with ASTM B584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.

5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
8. CWP Rating: 150 psig.
9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

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

    a. A.Y. McDonald Mfg. Co.
    b. Flowserve Corporation
    c. Homestead Valve: a division of Olson Technologies, Inc.
    d. Milliken Valve Company; a Mueller brand.
    e. Mueller Co. LLC; Mueller Water Products, Inc.
    f. R & M Energy Systems; Robbins & Myers

2. Body: Cast iron, complying with ASTM A126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 150 psig.
9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Valve Boxes:

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

    a. Kerotest Manufacturing Corp
    b. Perfection Corporation
    c. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated

2. Cast-iron, two-section box.
3. Top section with cover with "GAS" lettering.
4. Bottom section with base to fit over valve and barrel a minimum of 5 inches in

diameter.
5. Adjustable cast-iron extensions of length required for depth of bury.
6. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Service Pressure Regulators: Comply with ANSI Z21.80A.

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

   a. Actaris: a brand of ITT Controls
   b. American Meter Company
   c. Fischer; Emerson Electric Co., Automation Solutions
   d. Itron Inc.
   e. Richards Industrials
   f. Schneider Electric USA, Inc.
   g. Pietro Fiorentini

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: NBR; resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: UV-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to regulator.
9. Pressure regulator is to maintain discharge pressure setting downstream and is to not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless steel screen in opening if not connected to vent piping.

C. Line Pressure Regulators: Comply with ANSI Z21.80A.

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

a. Actaris: a brand of ITT Controls
b. American Meter Company
c. Dormont; A Watts Water Technologies Company
d. Eclipse Innovative Thermal Technologies
e. Fischer; Emerson Electric Co., Automation Solutions
f. Itron Inc.
g. Maxitrol Company
h. Richards Industrials
i. Schneider Electric USA, Inc.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: NBR; resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: UV-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to regulator.
9. Pressure regulator is to maintain discharge pressure setting downstream and is to not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. Canadian Meter Company, LLC; a Honeywell Company
b. Dormont; A Watts Water Technologies Company
c. Eaton
d. Harper Wyman Co]
e. Maxitrol Company
f. SCP, Inc

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: NBR.
6. Seal Plug: UV-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

9. Maximum Inlet Pressure: 2 psig.

2.8 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with ANSI B109.1.

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

   a. Actaris: a brand of ITT Controls
   b. American Meter Company
   c. Itron Inc.
   d. Schneider Electric USA, Inc.

2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Case and Index: Tamper resistant.
8. Remote meter reader compatible.
9. Pressure Loss: Maximum 1.0 inch wg.
10. Accuracy: Maximum plus or minus 1.0 percent.

B. Service-Meter Bypass Fittings:

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

   a. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated
   b. Williamson, T. D., Inc

2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

2.9 DIELECTRIC FITTINGS

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

B. Dielectric Unions:

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

a. A.Y. McDonald Mfg. Co.
b. Capitol Manufacturing Company
c. GF Piping Systems: Georg Fischer LLC
d. HART Industrial Unions, LLC
e. Jomar Valve
f. Matco-Norca
g. WATTS; A Watts Water Technologies Company
h. Wilkins
i. Zurn Industries, LLC

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

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

a. Capitol Manufacturing Company
b. GF Piping Systems: Georg Fischer LLC
c. Matco-Norca
d. WATTS; A Watts Water Technologies Company
e. Wilkins

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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

a. Advance Products & Systems, LLC
b. CALPICO, Inc.
c. GF Piping Systems: Georg Fischer LLC
d. GPT; a division of EnPRO Industries

2. Description:

a. Nonconducting materials for field assembly of companion flanges.

b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description and rated pressure of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping in accordance with the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for preventing accidental ignition.

3.3 INSTALLATION OF OUTDOOR PIPING

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping in accordance with ASTM D2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gauge upstream and downstream from each service regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."

3.4 INSTALLATION OF INDOOR PIPING

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

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

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.

G. Locate valves for easy access. Do not locate valves within return air plenums.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
2. Install sediment trap on both sides of regulators for gas reduction with valve and cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.5 INSTALLATION OF SERVICE-METER ASSEMBLIES

A. Install service-meter assemblies aboveground on concrete bases.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 INSTALLATION OF VALVES

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

F. Do not install valves in return-air plenums.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare

dimensions complying with SAE J513. Tighten finger tight, and then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.9 PIPING CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas-appliance equipment grounding conductor of the circuit powering the appliance in accordance with NFPA 70.

C. Where installing piping adjacent to appliances, allow space for service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between

valve and appliances or equipment.

3.10 LABELING AND IDENTIFICATION

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base in accordance with seismic codes at Project. See Section 230548 "Vibration and Seismic Controls for HVAC."

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000 psig 28-day, compressive-strength concrete and reinforcement.

3.12 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Test, inspect, and purge natural gas in accordance with the International Fuel Gas Code and authorities having jurisdiction.
2. Natural-gas piping will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping is to be one of the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
4. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping is to be the following:

1. Schedule 40 with threaded fitting for 2” and smaller.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, branch piping NPS 1 and smaller is to be one of the following:

1. Schedule 40 with threaded fitting for 2” and smaller.

B. Aboveground, distribution piping is to be one of the following:

1. Schedule 40 with threaded fitting for 2” and smaller.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, branch piping NPS 1 and smaller is to be one of the following:

1. Schedule 40 with threaded fitting for 2” and smaller.

B. Aboveground, distribution piping is to be one of the following:

1. Schedule 40 with threaded fitting for 2” and smaller.

C. Underground, below building, piping is to be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
4. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground portion of vent pipe and fittings with protective coating for steel piping.

3.17 UNDERGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves.
2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, [**lubricated**][**nonlubricated**] plug valves.

3.18 ABOVEGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter are to be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 and smaller are to be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

C. Valves in branch piping for single appliance are to be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

DFCM Electrical Design Requirements Updated: June 30, 2008	USU Electrical Design Requirements Updated: November 11, 2009

Not sure of the value onf a fdfa

The column below is the DFCM Electrical Design Requirements, Section 3.6. The version date is shown above. They are provided here as a reference for convenient coordination with the USU Electrical Design Requirements. The complete DFCM Design Requirements can be found at:

http://dfcm.utah.gov/StdDocs/index.html

UtahState UNIVERSITY

The column below is the USU Electrical Design Requirements. The version date is shown above. The USU Electrical Design Requirements include the DFCM Electrical Design Requirements, except as modified below. AutoCAD details are embedded at the end of this document. These guidelines are updated on a continual basis. The most recent version can be obtained at:

http://www.usu.edu/facilities/planning/DesignReq.cfm

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ELECTRICAL INDEX

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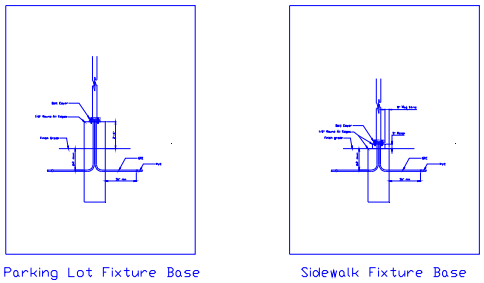
3.6 Electrical	3.6 Electrical
A. Codes and Standards	A. Codes and Standards
□ The following Codes and Standards are to be considered a minimum requirement for section 3.6. Where items contained in this section are in conflict with any of the following codes or standards the more stringent requirement shall apply. (1) National Electrical Code- NEC "2005" (2) International Building Code- IBC "2006" (3) International Energy Conservation Code- IECC "2007" (4) IESNA Handbook 9th Edition (5) UL 96A (6) NFPA 780 (7) Utah State Fire Marshals rules R710 (8) National Fire Alarm Code- NFPA 72 "2007	□ All electrical design shall be in accordance with the latest edition of the following codes: • National Electrical Code 2008 • Life Safety Code • Utah OSHA Regulations • NFPA 72
B. (Not Used)	B. (Not Used)
C. Lighting	C. Lighting
(1) □ Occupants within an enclosed space shall have the capability to adjust the lighting within the enclosed space.	(1) □ Where occupancy sensors are used, also provide a means for manual on/off control. □ List fixtures in the lighting schedule by manufacturer and part number. At the completion of the project update the schedule to indicate the actual fixture installed.
(2) □ All lighting shall meet or exceed the current energy code for watts per square foot, control requirements and other requirements. □ All lighting shall utilize the most efficient lamps and ballasts available for the application. □ All incandescent lighting must be approved by the DFCM	(2) □ Lighting shall be selected to best meet the functional and safety needs of the space - using codes, guides, standards and professional judgment as appropriate. □ Lamps and ballasts shall be in accordance with items (6) – (10) below.

representative.	
(3) Light Pollution Reduction: □ Comply with Light Pollution Reduction requirements, unless otherwise directed by the DFCM's Designated Representative. (4) □ Comply with the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: "Lighting for Exterior Environments (RP-33-99)." □ Provide exterior luminaires which are shielded. For luminaires with more than 3000 initial lamp lumens, provide Full Cutoff (IESNA Classification) luminaires. □ Interior lighting shall be positioned so that the maximum candela value does not fall outside the interior space, such as out through a window. □ Exterior lighting shall be located so that the maximum candela value of all exterior lighting shall fall within the property. □ Provide shielding for any luminaire within a distance of 2.25 times its mounting height from the property boundary so that no light from the luminaire illuminates past the property boundary.	(3) Light Pollution Reduction: □ Do not use "wall pack" type fixtures.
(5) Lighting Fixtures: □ Provide lenses that will not yellow due to exposure to sunlight or to the light sources in the fixture. When acrylic diffusers are specified, provide 100% virgin acrylic. □ Provide electronic ballast suitable for the load type, energy savings, and starting temperatures required. □ Provide program start ballasts, if available for the lamp type. □ Connect equipment grounding conductor to fixture housing. □ Provide 10% spare lamps, diffusers or glass for each light fixture type with not less than one for less than 10.	

(6) Interior Lighting: □ Provide T-8 lamps in fixtures, except for areas requiring special lighting. □ Provide independent safety-wires attached to structure at two diagonal corners of lighting fixtures in compliance with seismic requirements. □ For recessed fluorescent fixtures that are removable, locate outlet box with 3' of steel flexible conduit to the fixture to aid in removing and relocating fixture.	(6) Interior Lighting: □ Provide T-8 lamps in fixtures, unless otherwise approved. Submit non-T-8 lamped fixtures for approval □ Provide T-8 ballasts with the following characteristics: • <10% THD • Programmed Start • Universal input voltage 120 – 277 • GE Ultramax • OSRAM Sylvania Quicktronic High Efficiency (QHE) • Advance Optanium • Universal Ultim 8 □ Provide 32 Watt T-8 Lamps; 4100K. □ Exit signs: brushed aluminum finish; Green LED. Provide one of the following exit signs: • Lithonia LES Series • Cooper/Sure-Lites CX Series • Dual Lite SE Series □ Do not provide battery backup in fixtures or exit signs which are connected to a generator. □ Lighting in building transformer vault and main electrical room shall be connected to an emergency lighting circuit. □ Locate stairwell lighting over landings and intermediate landings. Wall mounted is preferred. □ Provide light fixture cutsheets of proposed fixtures with each drawing review.
(7) Exterior Lighting: □ Provide -10 degree F. ballasts, either constant wattage or pulse start. □ Provide break-away fuse for all phase conductors for all outside pole mounted lighting fixtures. Provide a shorting fuse insert for neutral fuse holder. Do not use common neutral multi-wire circuits for this type of lighting.	(7) Exterior Lighting: □ The following fixtures are to be used as the basis of design for site lighting projects. Contractors/bidders should submit pricing for the base fixture and for any other alternative fixtures as well as cutsheets and/or samples as necessary to evaluate the alternative fixtures. Alternative fixtures will be evaluated post bid against the base using the following criteria: 1) visual equivalency 2) light distribution 3) overall

	fixture quality/maintainability and 4) pricing. □ Historic/Street District Luminaire: Manufacturer: AAL; Style: UCM; Elements: Solid Rings (SR) Solid Cylinder; Hood: Straight Shade (STR); Lens: Flat Glass (FTG); Lamp/Ballast: Determined by project, but typically 150W–175 W MH; Arm: Offset Shepherds Crook (SLA 4); Pole: Smooth, round, aluminum, length = 12', decorative base cover (BC8); Color: Dark Bronze (DBZ); Other: Tool removal of lens rather than thumbscrews. Banner arms for street district. □ Mall District Luminaire: Manufacturer: AAL; Style: UCM; Elements: Illuminated Rings (LUM); Hood: Straight Shade (STR); Lens: Flat Glass (FTG); Lamp/Ballast: Determined by application, but typically 150w–175w MH; Arm: Offset Shepherds Crook (SLA 4); Pole: Smooth, round, aluminum, height = 12'; Color: Dark Bronze (DBZ). Other: Tool removal of lens rather than thumbscrews. Banner arms. □ Art District Luminaire Basis of Selection: Manufacturer: Bega; Style: 8171MH; Lamp/Ballast: Determined by application, but typically 150w–175w MH; Pole: Smooth, round, tapered, aluminum, height = 14'; Color: Dark Bronze □ General Campus: For areas other than one of the themed districts above, provide typical shoebox style fixture with square aluminum pole. Color: Dark Bronze. □ See Lighting Pole Base Detail below for base dimensional requirements. Concrete strength and reinforcing to be determined by the requirements of project. □ Provide minimum 1 ¼"underground raceway for site lighting circuits.

	 FIGURE C-1: Lighting Base Dimensions
(8) Reflected Ceiling Plan Coordination: □ Coordinate the lighting fixture with the reflected ceiling plan for suspended lay-in and surface mounted fixtures. □ Recessed lighting fixtures in acoustical tile ceiling shall be located centered on a single tile.	
(9) Lighting Fixture Supports: □ Provide swivel bases for stems supporting lighting fixture which exceed 12” in length.	
(10) HID Sources: □ Use metal halide sources, provide Pulse Start Metal Halide lamps and electronic ballasts. □ Where High Pressure Sodium sources are approved, use auto-regulating ballasts.	(10) HID Sources: □ Do not use High or Low Pressure Sodium sources.
D. Raceways to 600 V	D. Raceways to 600 V
(1) Raceways, Fittings, and Boxes.	(1) Raceways, Fittings, and Boxes.

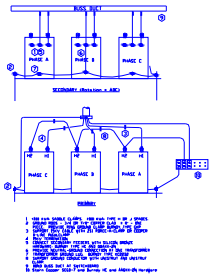
□ Provide steel raceway, fitting, and box system for all wiring, except that plastic conduit (minimum schedule 40) may be installed underground and aluminum cable trays may be installed for communications cabling. □ For steel raceway when installed in contact with soil, provide rigid or IMC PVC coated or wrapped raceways, fittings, etc. □ Provide steel raceways for penetrating structural elements (minimum 6" each side) and rigid steel conduit (PVC coated or wrapped) for bends greater than 30 degrees. □ Provide minimum ½" raceways, except Communication raceways shall be ¾" minimum. □ Provide flexible steel conduit (minimum ½") in short lengths where movement, vibration, misalignment or cramped quarters exist. □ Provide insulated throat or equal type plastic bushings for box connections. □ Provide liquid-tight flexible conduit with approved moisture-tight fittings for wet, humid, corrosive or oily locations. □ Provide a minimum 18" liquid-tight flexible conduit at each motor.	□ See the Fire Alarm specific raceway requirements. □ Record circuit numbers on the inside back of receptacle and lighting outlet boxes using a permanent marker or permanent label. □ Provide steel raceways for penetrating structural elements such as manholes and building foundations (minimum 4' each side) □ Provide minimum ¾" raceway except for HVAC controls, which may be ½". □ Raceway installed by HVAC or control contractors shall be installed by a qualified and licensed electrician. □ The consulting Electrical Engineer shall verify with the consulting Mechanical Engineer that electrical raceway requirements/specifications are included, or referenced, in the appropriate mechanical specification sections. □ Connectors on flexible conduit and MC Cable shall be the threaded type – not push-in quick connect type.
(3) Electrical Supports. □ All raceways, boxes, and conductors shall be supported independently from all other electrical or mechanical systems, directly from building structure by a listed supporting device. □ Provide outlet boxes with rigid support using metal bar hangers between studs.	
(4) Equipment Pads. □ Provide concrete pads a minimum of 6" beyond the dimensions of the equipment. Extend equipment pad a minimum of 4" above finished floor or grade.	
(5) Future Raceways:	(5) Future Raceways:

□ Provide five capped spare ¾" conduits from each section of a flush mounted branch panelboard into the ceiling and floor space. If the floor space is not accessible, provide an additional ¾" conduit from each section of a branch panelboard into the ceiling. □ Provide 200-lb nylon pull cord in all empty conduit, then cap raceway using a blank cover similar to adjacent wiring device covers.	□ All future raceways shall terminate in an accessible ceiling space. Extend as necessary.
(6) Underground Raceway Identification and Installation: □ Provide direct buried conduit in an area outside a building not less 24" deep, with magnetic "yellow warning" ribbon 12" directly above and 6" below finished grade measured from the top of the conduit or duct bank.	(6) Underground Raceway Identification and Installation: □ Medium voltage and communication distribution and building feeders shall have 36" minimum cover. □ Medium voltage conduits and ducts shall be concrete encased.
(7) Do not provide the following, unless approved by the Director: (8) □ Exposed cable wiring. (9) Other raceway systems: □ Electrical Non-metallic Tubing □ aluminum conduit □ die cast fittings □ steel cable trays.	
E. Conductors	E. Conductors
(1) Conductors.	(1) Conductors. □ Do not use push-in type quick-wire devices or wire connectors. □ 120/208 V color code: Black, Red, Blue; Clockwise Rotation. 277/480 V color code: Brown, Yellow, Violet;

	Clockwise Rotation. Orange is reserved for the High-Leg of center-tapped Delta system. □ #8 and larger conductors may be taped with 8" of half-lapped colored tape at terminations and pull boxes.
(2) Metal Clad Cable. □ Type MC Cable is allowed only when concealed in ceilings or walls. □ MC Cable must be protected from physical damage and supported directly from the building or structure by use of a listed support. □ MC Cable home runs are not allowed. Home runs must be in conduit from the electrical panel or cabinet to the first junction or pull box. □ MC Cable Used for Fire Alarm System Signaling or Initiation Circuits must have an overall outer coating of red.	(2) Metal Clad Cable. □ MC Cable is allowed only for lighting in accessible ceiling spaces and for other pre-approved applications. □ Do not use MC Cable for other electrical systems, fire alarm systems, communications systems, etc.
(3) Non-metallic sheathed cable may be used only for residential single or multi-family housing unless approved by DFCM Director. (4) Do not provide the following, unless approved by the Director: (3) □ Exposed cable wiring. (4) □ Splices in panelboard, switchboard enclosures, or in conduit bodies. (5) Other (unapproved) cabling methods: □ aluminum conductors	(3) Do not use Non-metallic sheathed cable
F. (Not Used)	F. (Not Used)
G. Medium Voltage	G. Medium Voltage

(1) Medium Voltage Conductors: □ Provide copper conductors with copper tape shields and EPR insulation and 100% copper neutral in Medium Voltage Ductbanks; or, in utility tunnels or other areas without public access, provide armored cable or rigid conduit. □ Comply, as a minimum, to the installation requirements for Medium-Voltage Cable standard NECA 600-2003. □ Perform Hi-Pot test after terminations have been made, but before connections have been made to buses or apparatus. □ Perform continuity tests of all cables after entire installation and terminations have been completed. □ If a cable fails to perform, replace faulty cable and retest. □ All tests will be recorded and submitted with O&M manuals at project conclusion.	(1) Medium Voltage Conductors: □ Do not place conductors in utility tunnels. □ Provide single conductor, MV-105, 133% insulation, 15KV cables □ Provide 3 days notice to USU Power of pending Hi-pot tests. Tests will be observed at USU's discretion. □ Hi-Pot test results shall be submitted to USU Power for review prior to equipment being energized. □ Provide support and racking for 15KV conductors using the following hardware: • ZSI Porce-a-Clamp or Cooper B-Line Insulclamp • B-Line B409-XX Shelf Bracket • B-Line B822 or 823 End Cap □ Contractors who have not previously performed medium voltage work shall submit documentation of 5 years experience in performing projects of a similar nature. □ A brush or swab equal to the diameter of the conduit shall be pulled through all existing and new underground ducts prior to placing cable. □ Provide a service loop in 15KV cables by routing cables one time around the perimeter of the manhole. □ Two sets of feeders which loop in and out of a switch, transformer or junction shall be located in separate duct banks. □ 15KV color code: Black, Red, Blue. 8" of half-lapped colored tape at terminations and pull boxes. □ Cable shall be value selected based on the following criteria: 1) Cost 2) Warranty 3) Installation labor savings. □ Approved cable Manufacturers: • Kerite • Okonite
(2) Medium Voltage Duct Banks.	(2) Medium Voltage Duct Banks

□ For interior of buildings in non-public areas, provide rigid galvanized conduit or armored cable marked with red HIGH VOLTAGE. □ For exterior applications or public areas, provide concrete encased duct-banks (red dye) with raceways in multiples of two and a minimum of one spare conduit (with polypropylene pull wire) per feeder. □ Provide rigid metal conduit for the first 10 feet of duct bank from a facility or manhole. □ Provide minimum 4" raceway.	□ Provide concrete encased PVC ducts throughout. Duct bank should penetrate manhole walls or building foundations. Reinforce duct with rebar at manhole and building penetrations. □ Provide minimum 5" or 6" raceway for distribution grid. 4" minimum for building feeder raceway. □ Provide at least one spare raceway in all medium voltage cable and duct runs. □ Where multiple sets of feeders run adjacent to one another, provide a physically separate ductbank with two raceways. □ A brush or swab equal to the diameter of the conduit shall be pulled through all existing and new underground ducts prior to placing cable. □ Beneath padmounted medium voltage switchgear provide a 36" deep cable well. Concrete encased duct bank shall penetrate cable well foundation wall without raceway elbows.
(3) Medium Voltage Transformer:	(3) Medium Voltage Transformer: □ Provide copper windings. □ Provide voltage adjustment taps. □ Transformers shall be configured and located as follows in order of preference: 1. 3-single phase transformers located in basement or ground level transformer vault within building envelope. 2. 3-single phase transformers or padmount transformer located in basement level areaway adjacent to building envelope. 3. Padmount transformer located in grade level transformer yard screened with materials matching building exterior. □ Transformer shall be protected by a stand alone fault interrupter. See Section (F)(6) □ Transformers shall be filled with less flammable vegetable

	based insulating oil. □ Provide through-tank 200A bushing wells and inserts on all non-overhead transformers including 3-phase padmount transformers, 1-phase transformer in 3-phase banks and 1-phase transformers. Provide a feedthrough bushing insert on each 1-phase transformers connected in a 3-phase delta bank. □ Connect secondary feeders to transformer using silicon bronze hardware. Burndy type HE and QQAXX-2N.  FIGURE G-1: Vault Transformer Connections
(4) Lightning Protection: □ Provide lightning (surge) arresters for medium voltage transformers and switchgear located above ground outside.	
	(5) Multi-Way Medium Voltage Switchgear: □ 15KV nominal voltage rating; 600A current rating; 12.5KA symmetrical interrupt rating □ Switchgear to be encapsulated solid dielectric. □ Provide front mounted 600A apparatus bushings. Diagonal arrangement. □ Handle/operator shall be front mounted. □ Switchgear shall be operable both manually with a handle and with a fixed motor operator & portable control. □ Provide pad lockable switch operating mechanism

	□ Switchgear located in vaults shall be of submersible design. □ Switch module bussing shall be field connectable and expandable to create switch arrangements from three – six ways. □ For 3, 4, and 5 way switches, provide an expanded support rack which will accept 1, 2 or 3 additional future switch modules. Verify the expected future way count with USU during design phase. □ Switchgear shall have visual indication (other than operating handle) of switch contact position. □ Width of each 3 phase switch module shall be 18” max. □ Allow 18” minimum from end of switch line-up to manhole/vault wall for manual switch handle operation. Indicate this required clearance on plans. □ Vault switchgear shall be stand mounted. 68” from floor to top of switch module. 76” from floor to top of motor operator. □ Pad mounted switchgear shall be placed on a 36” deep cable well. □ Submit shop drawings to USU for approval prior to manufacturing switch. □ Installing contractor shall provide and attach an engraved label with 1”high letters on each switch and switch way. Verify label content with USU. □ Approved Suppliers (Manufacturers): • G&W Electric – Trident Series
	(6) Medium Voltage Fault Interrupters □ These guidelines are for VFI’s when used stand alone or as part of multi-way switchgear □ 15KV nominal voltage rating; 200A current rating; 12.5KA symmetrical interrupt rating. □ 3 Phase or 1 Phase. □ Fault interrupters to be encapsulated solid dielectric. □ Provide front mounted 200A deepwell bushings: Provide

	diagonal bushing arrangement when part of multi-way switch gear. Straight bushing arrangement when VFI is used stand alone. □ Handle/operator shall be front mounted □ Interrupters shall be operable both manually with a handle and fixed motor operator & portable control. □ Interrupters shall not be located in subsurface vaults. □ Interrupter shall have visual indication (other than operating handle) of switch contact position. □ Interrupters shall be wall or stand mounted. 68" from floor to top of switch module. 76" from floor to top of motor operator. □ Provide pad lockable operating mechanism □ Provide protective relay with: • Settings viewable and adjustable via the front panel. • Minimum trip range: 15 – 300A • Front panel phase & trip cause indication • Adjustable phase time delay • Selectable trip curves • External power supply input • Manual trip button □ Submit shop drawings to USU for approval prior to manufacturing switch. □ Installing contractor shall provide and attach an engraved label with 1"high letters on each VFI. Verify label content with USU. □ Approved Suppliers (Manufacturers): • 3 Phase: G&W – Trident Series w/Type 2 Control • 1 Phase: G&W – Trident Series w/Type 1 Control
	(7) Medium Voltage Manholes, Vaults and Pads □ Provide subsurface concrete manholes where medium voltage switchgear is to be located or where medium voltage ducts change direction or as needed as a pull point in long duct runs.

- Where medium voltage switchgear up to 4 ways is anticipated, provide 10'x12' or 12'x12' manholes.
- Where medium voltage switchgear up to 6 ways is anticipated, provide 10 x 14' manholes.
- Allow 18" minimum from end of switch line-up to manhole/vault wall for manual switch handle operation. Indicate this required clearance on construction plans.
- Provide vertical struts embedded in (preferred) or attached to manhole wall extending from 12" above floor to 12" from manhole ceiling. Provide 3 per wall.
- Locate the manhole access in the half of the manhole opposite the switch (prefered) or centered.
- Provide steel or composite manhole ladders.
- Grounding hardware in 15 KV manholes and building vaults shall be silicon bronze. Burndy Type HE and QQAXX-2N; Storm Copper SCGB-7 ground bar.
- Ground all metal parts, ladders, manhole rings, supports, etc.
- Transformer vaults shall be ventilated according to NEC 450.45
- Extend concrete pad 6' on the door side of padmounted switches and transformers.
- Do not run piping/equipment from other systems through transformer vaults/manholes.

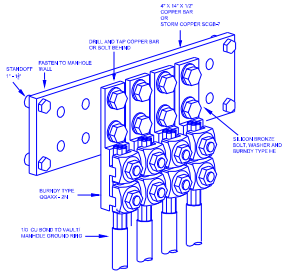


FIGURE G-2: Manhole-Vault Grounding Connection

	(8) Medium Voltage Terminations □ Provide 200A & 600A, 15KV separable connections at all switches and junction points. □ Provide voltage test points on all 200A separable connectors/elbows □ All elbow terminations shall be made up so that CT style fault indicators can be placed at the cable termination. □ Route drain wires from elbow along cable with sufficient length that elbows can be removed individually without disconnecting drain.
	(9) Medium Voltage Fault Indicators □ USU Power will install fault indicators on all terminations at multi-way switchgear and multi-point junctions. □ Fault indicators shall have the following characteristics: • Automatic current range sensing from 50 – 800A • Inrush restraint • 12 hour time delay reset • Integral fault indicator display • Battery-less operation □ Fault indicator CT to surround tape shield and tape shield braid. □ Approved Fault Indicator Manufacturers: • E.O. Schweitzer 1ARUI12Y2
	(10) Implementation □ Removal and/or re-configuration of medium voltage cable and ducts that results in the interruption of service to facilities will need to be done off hours – Saturdays, Sundays, overnight, etc. Verify outage requirements and include outage restrictions in bid documents. □ Requests for outages of medium voltage infrastructure and/or facilities requires 10 days advanced notice.

	□ Use the following labeling scheme for medium voltage equipment: [equipment type] [building/grid number]-[sequence] VFI (fault interrupter) 12L 1 CB (circuit breaker) 68B 2 SW (section switch) 14M 3 T (transformer) 14 Etc. MH (man hole) Etc. Examples: VFI 68B-1, CB 50-2, MH 12M-23, SW 13L-7 , T 67-1
H. Controllers	
(1) Motor controllers: □ Provide NEMA rated magnetic motor controllers with thermal overload relays for each phase.	(1) Motor Controllers: □ Do not provide IEC rated motor controllers.
(2) Variable Frequency Drives: □ Provide variable frequency drives suitable for the application, factory pre-wired with integral disconnect, input filter, and integral ventilation. □ For interior location VFDs, size ventilation for ambient temperature of 32 degrees F. to 90 degrees F. □ Avoid outdoor location mounted VFDs; but, if required, provide ventilation for ambient temperatures from -30 degrees F. to 120 degrees F. □ Fault current rating shall be sized based upon the fault current analysis of the nearest upstream overcurrent device. □ Include factory startup and tune to optimize life of motor. □ Provide VFCs which operate within the following normal ranges of inputs: +/- 10% input voltage; +/- 5% input	(2) Variable Frequency Drives: □ Approved Suppliers (Manufacturers): • Energy Management Corporation (Mitsubishi) • Long Building Environments/Bisel (Yaskawa) • Midgley-Huber (ABB) □ Drives shall not be located outdoors, except when a building environment is unavailable ie: farm irrigation pumps. □ Provide externally operated input circuit breaker. □ Provide one of the enclosure types (in order of preference): • Located integral in new MCC's. • Non-ventilated, NEMA 12 style enclosure and drive (25 HP and below only) • Ventilated enclosure with filtered forced air cooling. □ For motors 10 HP and larger, provide a minimum power quality

frequency; less than 7% voltage THD. (3) □ Provide a manual bypass of the VFD as part of controller	performance of 12% current THD and 3% voltage THD measured at the VFD input terminals. This shall be accomplished by using Harmonic filters or a minimum of 12 pulse drive. For motors less than 10 hp provide AC Line Reactors with a minimum of 3% Impedance. Provide output filtering if the motor is located more than 50 feet from the drive. See DFCM Power QualitySection J (6) □ The PQ filter shall be separated from the VFD by internal separation or with separate enclosures. If mounted in separate enclosures both the PQ filter section and the VFD shall be mounted on a common backplane/rack assembly. Filter section shall be ventilated. VFD section shall be gasketed non-ventilated or ventilated as described above, depending upon machine room space availability. □ Filters/transformers shall be factory wired. □ Do not provide a manual bypass. For systems that require minimal downtime, incorporate a redundant VFD scheme. □ Provide 3 year warranty minimum. □ Controls, indicators and keypad shall be front panel/door mounted. □ Provide UL 508 Listing on assembled drive. □ After vendor startup of the VFD, USU will conduct in-house power quality testing for those items listed in the design requirements. Reserve project budget allowance of $300 per drive for testing. □ Permanently label all internal wiring □ Control voltages to be 120V □ Provide fire alarm fan/VFD shutdown input. □ Doors will not require special wrenches, tools or keys to open. □ Rather than connecting motor feeders directly to VFD output, provide a terminal block for VFD feeders to connect to. Install factory wiring between terminal block and VFD output terminals.
I. Electrical Distribution	I. Electrical Distribution

(1) Overcurrent and Ground Fault Protection: □ Set overcurrent and ground fault protection based upon Fault Current Protection and Coordination Study prepared by the A/E.	(1) Overcurrent and Ground Fault Protection: □ When determining settings for protective devices, request settings from USU for existing upstream medium voltage protective equipment. □ USU personnel will program and install settings into medium voltage protective devices. □ Phase Coordination Scheme (fastest to slowest): 1. Building secondary protective device. 2. Substation Recloser Fast Curve. 3. Building medium voltage protective device. 4. Substation recloser slow curve. 5. Recloser lockout. □ Ground Fault Coordination Scheme: 1. Secondary Ground Fault Device Exists: Coordinate secondary ground fault protective device faster than medium voltage ground fault protective device. 2. No Secondary Ground Fault Device Exists and Secondary Voltage is 120V: Maximum VFI Ground Fault Setting or Blocked. Ground fault short time trip to match phase short time trip. 3. No Secondary Ground Fault Device Exists and secondary voltage is 277V: VFI ground fault settings per NEC reflected to primary side).
(2) □ Submit study with O&M manuals.	□ Submit Fault Current Protection and Coordination Study prepared by A/E to USU for review and approval at least 4 weeks prior to building occupancy. Submit printed output (pdf) and digital model file (SKM Powertools format).
(3) Transformers: □ Provide transformers with copper conductors. □ Provide transformer taps of 4 taps – 2.5% above normal and 2 taps – 2.5% below normal.	(3) Transformers: □ Do not provide dry type transformers except as part of emergency or life safety distribution systems. □ If two system voltages are required, provide two oil filled

□ Adjust voltage output to obtain the proper value at the main disconnect.	transformers and two services.
(4) Metering: □ Provide secondary digital metering (including demand monitoring) at the main distribution panel(s) in each facility. □ For secondary digital metering for facilities greater than 800 Amps include harmonic monitoring and an option for building automation monitoring or other remote monitoring.	(4) Metering: □ Provide metering at each service. □ Provide metering for temporary construction power. □ In buildings with multiple tenants, provide separated metering or sub metering as appropriate. □ Where current transformers are used, provide engraved label with 3/8”minimum high letters indicating CT ratio and multiplier. Attach label to electrical panel or meter base immediately below meter. □ Provide CT’s with 5 Amp secondary. □ CT’s shall be secured to MDP or transformer with appropriate brackets. Do not hang from secondary feeders. □ Provide neutral CT in 3 Phase metering schemes. □ Provide a Current Transformer Test Record for each CT which includes: Ratio; Ratio Correction Factor at 10% and 100% load; Serial Number; Date of Test. □ Provide a ¾” EMT from the MDP metering section or meter base to the building communication BDF. □ MDP Meters (LCD display; 5A input; Modbus/DNP; 232/485; IR; Ethernet; 10B-T; 10B-FL). Accepted Manufacturers: • Square-D Power Logic ION 7550 • Seimens ION 9510 • Electro-Industries Nexus 1250 □ Three Phase Transformer Rated (CT) (LCD display; Form 9S; Blade Powered; 5A input; Modbus/DNP; IR; Ethernet; 10B-T). Accepted Manufacturers: • Electro-Industries Nexus 1262 • Power Measurement Ion 8600 • Itron Centron CP1SD CL20 □ Three Phase Direct Read (IR; Demand, Form 16S) Accepted

Manufacturers:

- Itron Centron CP1SD CL200 or CL320

□ Single Phase Direct Read (IR; Demand, Form 2S)

Accepted Manufacturers:

- Itron Centron C1SD CL200 or CL320

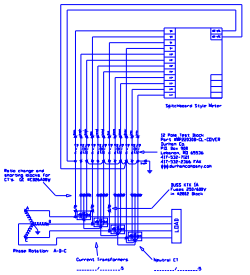


FIGURE I-1: MDP Metering

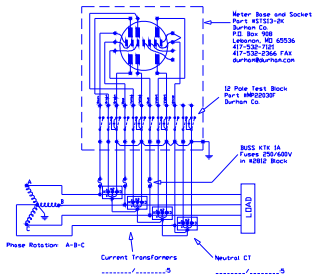


FIGURE I-2: Socket Meter with Neutral CT

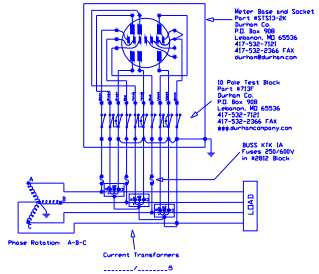


FIGURE I-3: Socket Meter without Neutral CT

(5) Utility Metering:

- □ Comply with serving utility's regulations, if applicable.
- □ Comply with utility's metering requirements. Include cost assessed by serving utility.

(6) Switchboards and Panel boards:

- □ Provide bus hardware installed on the bus for future over-current devices of not less than 25% minimum.
- □ Provide over-current devices in the same sequence as shown on the panel schedules or one-line diagrams.

(6) Switchboards and Panelboards:

- □ Provide copper bus in switchboards.
- □ Provide dedicated main electrical room for building switchboards. Access to main electrical room shall be directly to the corridor not passing through communications rooms, mechanical rooms, office spaces, etc.
- □ Locate electrical rooms so that they stack vertically.
- □ Do not put grid ceiling systems, sheet rock ceilings or finished ceilings in electrical rooms – leave open to structure.
- □ Provide 4" raised concrete pad for all floor mounted electrical equipment.
- □ Provide 120V convenience outlets in transformer vaults, main electrical rooms and electrical panel closets. Convenience outlets in transformer vaults and main electrical rooms shall be connected to building generator.
- □ Use the following labeling scheme for panelboards:

	[building level][panel type][panel sequence][section] 0 M (Main) 1 A 1 P (120/208) 2 B 2 L (277/480) 3 C 3 E (Emergency) 4 Etc Etc. S (Standby) Etc. MCC (Motors) Examples: ML, 0P1, 2P5B, 0EL1, 1SP1, 3MCC1
(7) Panel boards: □ Provide listed panelboard construction for all branch panels and circuit breaker distribution panels. □ Load centers and plug in circuit breakers may be used only in Residential Single and Multi-family residences unless approved by the DFCM Director. □ Key all panelboards alike and provide 3 keys.	(7) Panelboards: □ Locate electrical rooms so that they stack vertically. □ Do not provide 3 phase 4 wire delta systems □ Provide dedicated electrical rooms/closets for panelboards. Access to electrical rooms/closets shall be directly to the corridor not passing through communications rooms, mechanical rooms, office spaces, etc. Closets may be shallow so that NEC required clearance extends into the corridor. □ Provide copper bus in panelboards. □ Do not put dropped ceiling systems in electrical rooms/closets.
J. Power Quality	J. Power Quality
(1) □ The A/E shall include as a basis of design an evaluation of potential Harmonic Risks to the Electrical Distribution System and provide a plan to mitigate these risks. □ The Power Quality Plan shall be approved by the DFCM representative. □ Power Quality Testing may be performed by the DFCM after the facility is occupied to determine the effectiveness of the Power Quality Mitigation approach.	

(2) Electrical Services. a. Services of 300 KVA or larger shall be 277/480 volt at the Service Main Disconnecting means except for those proven to be unnecessary and approved by the DFCM Director. b. Harmonic producing (non linear) loads such as Lighting, VFD's, UPS's and Computer rooms shall be separated or grouped as far as reasonably cost effective. c. All Panels fed from a Step Down transformer shall have 200% Neutral feeders. d. All multi-wire branch circuits with shared neutrals shall have an oversized neutral. This neutral shall be at least one trade size larger than the phase conductors. e. Provide 277 volt lighting wherever there is a 277/480 volt wye service available.	(2) Electrical Services. □ For buildings requiring both 120/208 and 277/480 voltages, provide dual services consisting of a transformer, feeders, disconnects and switchboards.
(3) Existing Electrical Services. □ Power Quality Testing should be performed prior to the Upgrade, Addition or Alteration of any of the following Electrical Components or Systems, VFD's, UPS's, Step Down Transformers and Generators. □ It shall be determined from this testing the proper equipment and method to be used that will insure that the existing system will not be adversely affected by the work to be performed. Power Quality Testing should be performed after completion to determine the effectiveness of the material and methods used.	
(4) Power Factor. □ All new Construction or Upgrade of existing Electrical Services shall meet the minimum requirement of 95% and Maximum of 98% Power Factor. □ The DFCM Representative shall approve the method and layout of Power Factor Correction Capacitors prior to installation.	(4) Power Factor □ Provide power factor correction capacitors for motors 5 HP and larger and not connected to VFD's.

(5) Step Down Transformers. a. All Step Down transformers shall be Energy Star Nema TPI K-rated or HMT with 200% Neutral capability, unless proven unnecessary and approved by the DFCM Representative. The K-Rating shall be as determined by Manufacture recommendations for the equipment they serve. b. All Step Down transformers feeding Computer rooms or areas subject to high Non Linear loads shall be fed from a Harmonic Mitigating Transformer with 200 % Neutral.	(5) Step Down Transformers. □ Step down transformers shall not be used except for use on backup generator systems.
(6) Variable Frequency Drives. a. For motors 10 HP and larger, provide a minimum power quality performance of 12% current THD and 3% voltage THD measured at the VFD input terminals. This shall be accomplished by using Harmonic filters or a minimum of 12 pulse drive that will comply with the power quality performance requirements. For motors less than 10 hp provide AC Line Reactors with a minimum of 3% Impedance. Provide output filtering if the motor is located more than 50 feet from the drive.	
(7) Lighting. Electronic Ballasts: a. shall have <20% THD for 277 volt lighting systems and <10% THD for 120 Volt Lighting Systems. In Existing Buildings where high Harmonic Currents are present provide <10% THD Ballasts.	(7) Lighting. Electronic Ballasts: □ All ballasts shall have < 10% THD
(8) Generators. a. For new construction a service that is to be backed up by a Generator shall be designed to have no more than 12% Current THD or 3% Voltage THD. For Existing Services to be backed up by a Generator Power Quality Testing shall be performed to	

determined that there is not more than 12% Current THD or 3% Voltage THD and that there is not a leading Power Factor. If there is it shall be corrected prior to bringing the Generator online.	
(9) Uninterruptible Power Supplies. a. Provide a minimum Power Quality performance of 12% current THD and 3% voltage THD measured at the UPS input terminals. Provide filtering if necessary.	
(10) Transient Voltage Suppression System. a. TVSS Shall be provided for the main service of each facility with services greater than 200 Amps. A second level of TVSS shall be provided for panels serving primarily computer or non linear loads.	
K. Miscellaneous Electrical	K. Miscellaneous Electrical
(2) Wiring Devices:	(2) Wiring Devices: □ Conductors shall be connected to wiring devices using threaded screws. Do not use push-in quick-wire connections. □ Do not use GFCI feed-throughs. If multiple devices need protected, use multiple GFCI outlets or a GFCI circuit breaker. Exception: where all outlets are located above a continuous countertop. □ Convenience outlets (120 V) and switches (120/277V) shall be minimum 20A self-grounding with nylon faces and nylon or stainless steel cover plates.

(3) Lightning Protection: □ If the risk analysis performed per NFPA 780 or UL 96A exceeds moderate risk, provide a lightning protection system. □ Minimum qualifications required: LPI-certified installer, designer, and inspector. □ Obtain a UL Master Label for the facility.	
(4) Generators. □ Generator Fuel Tank Size. Size fuel tank to comply with the needs of the facility or a minimum of 24 hours of operation at full load capacity.	(4) Generators. □ Size fuel tanks to provide 48 hours of continuous operation at generator full load. □ Provide skid mounted fuel tanks □ Fuel tanks shall be constructed of steel. □ Generators shall be located 1) within the building envelope on the basement or ground level or 2) a sub-surface areaway adjacent to the building. □ Locate generator exhaust outlet where it is not adjacent to building openings or HVAC intakes. □ Locate the generator annunciator next to the transfer switch. □ Generator EPA Emission Rating shall be Tier II or above. □ Approved generator manufacturers: • Kohler • Caterpiller • Onan
(5) Hazardous Classifications. □ Coordinate with the State Fire Marshall hazardous classifications and requirements, including class, division and group requirements.	

L. Structured Cabling	L. Structured Cabling
(1) Test all structured cablings systems to demonstrate compliance with TIA/EIA standards for the category of system selected. Include warranty and the test results in the Project Resource Manual.	□ Provide dedicated main communication room (BDF). Access to BDF shall be directly from the corridor, not passing through electrical rooms, mechanical rooms, office spaces, etc. □ Provide dedicated communication rooms throughout the building (IDF). Access to IDF's shall be directly from the corridor not passing through electrical rooms, mechanical rooms, office spaces, etc. □ Locate BDF and IDF's so that they stack vertically. □ Power outlets located in communications rooms shall be connected to the back-up generator. □ Upon entering the building, outside plant conduit shall run continuously to the BDF. Do not provide cable tray or junction boxes in these raceway sections.
M. Fire Alarm	M. Fire Alarm
(1) □ Provide addressable fire alarm systems as required by State Fire Marshals Rules R710. The Installation shall comply with State Fire Marshals Rules R710 and NFPA 72.	(1) □ Fire Alarm systems and designs shall incorporate State Fire Marshals Rules section R710-004 □ Fire Alarm systems and designs shall be in accordance with the latest version of NFPA 72
(2) □ Install class "A" looped systems or as approved by Fire Marshal.	(2) □ Provide NFPA 72 Style D initiating circuits, Style Z notification circuits and Style 6 or 7 signaling line circuits (State Fire Marshal Requirement 3.3.3.3.1)
(3) □ Do not use the following components, unless approved by the Director. Other Fire Alarm Components: □ Zoned Fire Alarm panels □ ionization smoke detectors.	

(4) Equipment and Materials

- Use the following symbols for fire alarm drawings. For Design/Construction drawings use the monochrome symbols. For As-Built/Record drawings use the colored symbols.

FIGURE M-1: Fire Alarm Symbols

- Fire alarm concealed raceway and boxes shall be red in color. Where raceway is exposed, paint to match adjacent wall or ceiling and provide red label with white lettering every 20' indicating: "FIRE ALARM". Approved labels:
  - Seton Opti-Code
  - Others as shown

FIGURE M-2: Fire Alarm Exposed Conduit Label

- The fan shut down relay(s) in the air handling equipment shall be normally energized, and connected through and controlled by a normally closed contact in the fire alarm panel, or a normally closed contact of a remote relay under supervision by the main panel. The relays will transfer on alarm, and shall not restore until the panel is reset (State Fire Marshal Requirement 3.3.3.4.1)
- All fire alarm equipment shall be UL Listed or listed by another national testing lab.
- Door holders to be Firelite FM Series
- Provide Notifier FDU-80 Annunciators
- Provide readily visible remote indicating lights for concealed duct detectors (see NFPA 72).
- Provide manual pull stations at each ground level exit
- Where the hardware allows, audible annunciation devices shall be silence-able via the FACP front panel while allowing visual annunciation devices to remain in alarm.
- Approved fire alarm system vendors:
  - Notifier

(5) Design Requirements

	□ Provide battery backup capacity capable of operating system after a 48 hr outage x 15 minute alarm. □ For sprinkler system water gongs provide weatherproof horn/strobe 12' h above FDC, activated only by water flow and deactivated only by water flow cessation. □ Fire Alarm Central Panel (FACP) alarm reporting shall be via dry telephone pairs to the USU Fire Alarm Master Panel (FAMP). Do not provide fire alarm dialers. Run ¾" EMT and 2 conductor cable from fire panel (FACP) to building main telephone distribution closet (BDF). □ Provide one circuit per NAC □ The following items should be on or attached to the design drawings: • battery capacity calculations • visual device candela rating • audible device sound pressure rating and actual setting • I/O matrix • FCPS location and number • Sound pressure design analysis, calculations or modeling
	(6) Implementation □ Prior to commencing construction, the contractor will visit an existing fire alarm installation with USU personnel to review how the details and requirements of this document are to be implemented. □ Prior to commencing construction, the contractor shall provide fire alarm shop drawings and equipment submittals to USU for review and approval. Include: • equipment and device cutsheets • battery calculations • visual device candela rating • audible device sound pressure rating and actual setting • I/O matrix • FCPS location and number

	□ Contractor shall request from USU a visual inspection of all fire alarm conduits prior to being concealed by sheetrock or other construction material. □ FACP device point labeling should be descriptive and accurate. For example: SMOKE (PHOTO) HALL BY RM 106B BSMT LEVEL 1. □ Devices shall be visibly labeled with the corresponding loop number and device address. Example: L2, L1D07. □ Device labels shall be applied to the fixed portion of the devices (device base rather than to removable device). □ Label devices with an adhesive type labeling tape. □ Contractor shall keep redline drawings current throughout the project showing: • conduit routing • location of all devices, relays, control modules • device connection order • device address
	(7) Testing and Close-out □ Prior to final inspection contractor shall: • Conduct 100% pre-test of entire system. • Submit panel history print showing 100% testing • Submit Record of Completion. See NFPA 72 (4.5.1.2)

FUNDAMENTALS OF FIRE ALARM SYSTEMS 72-53

FIRE ALARM SYSTEM RECORD OF COMPLETION

To be completed by the system installation contractor at the time of system acceptance and approval.

1. PROTECTED PROPERTY INFORMATION

Name of property: _____
Address: _____
Description of property: _____
Occupancy type: _____
Name of property representative: _____
Address: _____
Phone: _____ Fax: _____ E-mail: _____
Authority having jurisdiction over this property: _____
Phone: _____ Fax: _____ E-mail: _____

2. FIRE ALARM SYSTEM INSTALLATION, SERVICE, AND TESTING INFORMATION

Installation contractor for this equipment: _____
Address: _____
Phone: _____ Fax: _____ E-mail: _____
Service organization for this equipment: _____
Address: _____
Phone: _____ Fax: _____ E-mail: _____
Location of as-built drawings: _____ Location of historical test reports: _____
Location of system operation and maintenance manuals: _____
A contract for test and inspection in accordance with NFPA standards is in effect as of _____
Contracted testing company: _____
Address: _____
Phone: _____ Fax: _____ E-mail: _____
Contract expires: _____ Contract number: _____ Frequency of routine inspections: _____

3. TYPE OF FIRE ALARM SYSTEM OR SERVICE

NFPA 72 Chapter Reference of System Type: _____
Name of organization receiving alarm signals with phone numbers *(if applicable)*:
Alarm: _____ Phone: _____
Supervisory: _____ Phone: _____
Trouble: _____ Phone: _____
Entity to which alarms are retransmitted: _____ Phone: _____
Method of retransmission of alarms to that organization or location: _____

 NFPA 72 (p. 1 of 1)

FIGURE 4.5.2.1 Record of Completion.

2007 Edition

FIGURE M-3: Record of Completion Form

- □ Acceptance tests for fire alarm systems shall include:
  - 48-hour x 15-minute battery back-up test
  - Visual inspection of all devices and conduit
  - Visual coverage of strobe annunciation
  - Measurement and verification of min/max sound levels
- □ Place a printed and bound copy of the record drawings in the FACP panel door.
- □ Prior to project close out, provide digital (dwg & pdf) and printed record drawings and O&M Manuals showing:
  - conduit routing
  - location of all devices, relays, control modules
  - device connection order
  - device address

	• equipment and device cutsheets • battery calculations • visual device candela rating • audible device sound pressure rating and actual setting • I/O matrix • FCPS location and number • panel programming information • device point report
N. Misc. Systems	N. Miscellaneous Systems
(1) Determine requirements for other systems such as security, cctv, etc.	
	(2) Security □ Provide addressable security systems. □ Security Alarm Panel (SAP) reporting shall be via dry telephone pairs (no dial tone) to the USU Master Fire Alarm Panel (FAMP). Do not provide alarm dialers. Run ¾" EMT and 2 conductor cable from security panel (SAP) to building main telephone distribution closet (BDF) or (IDF). Coordinate final connection of SAP with USU. □ Provide short isolation modules at the beginning of each branch of a "star" configured wiring layout. □ Approved security system vendors: • Ademco Vista
	(3) CCTV □ CCTV systems shall be IP based ONNSI NetDVMS and Ocularis client □ Include the following items on CCTV Design Drawings: • Camera schedule showing camera and lens requirements

	(4) Access Control □ Provide Access Control Systems by TAC □ Provide one (minimum) access controlled exterior door per building □ Utility tunnel entries shall be access controlled. Connect to nearest system access control panel.
	(5) Clocks □ Provide battery powered clocks □ Clocks to be radio transmitter synchronized. □ Approved Vendors: • Primex
	O. Other
	□ Provide electronic submittals and shop drawings for all equipment and systems. □ Provide As-built drawings in AutoCAD (dwg) and Adobe (pdf) formats. □ Submit this checklist with the construction/final/100% documents. Check items accordingly: x, na or provide explanatory text as to why items were not implemented.

REVISION LOG

6/09/09: Updated Fire Alarm Symbols
4/09/09: Add Dual Lite SE Series exit sign
3/30/09: Final Fire Alarm Items; Remove General Cable; Tunnel doors to be access controlled; wall mount stairwell lighting; power factor correction
2/24/09: Numerous Fire Alarm Updates.
2/24/09: Provide motors only on 15KV Switches. Do not provide motor controller.
2/24/09: Provide B-Line 822 or 823 End Cap on MV Manhole Shelf Brackets.
2/24/09: Provide As-built drawings in dwg and pdf format.
2/24/09: Record circuit number in the back of receptacle and lighting outlet boxes.
2/24/09: Remove TMS-Danfoss as a VFD supplier
2/24/09: Provide Electronic submittals and shop drawings.
2/24/09: Provide steel or composite manhole ladders instead of fiberglass.
3/10/08: Eliminate Generac
1/22/08: Change Notifire LCD-80 to FDU-80
1/07/08: Indicated fixed motor operators on 15KV switches rather than the option for fixed motor operators.
12/7/07: Fixed phase reversal error in meter details
11/19/07: Clarified single phase direct read and three phase transformer rated meters
10/16/07: VFD cabinet clarification: NEMA 12 only on 25HP and below
7/9/07: Inserted details in Word 2007 compatible way
6/11/07: Vault Transformer Connection Detail
6/5/07: Clarify 15KV switch height.
4/24/07: Site Lighting fixture bidding details
4/17/07: Provide Notifier LCD-80 Annunciators
4/9/07: Added Pre-Fab man hole grounding bar
3/19/07: Updated metering test block part numbers
3/9/07: Fire Alarm raceway labels
3/8/07: Motor operators – fixed and/or portable.
3/5/07: Temporary/construction metering
3/5/07: Exposed Fire Alarm raceway labeling requirements
2/23/07: Medium Voltage Equipment Labeling
2/23/07: Elbow termination drain
2/21/07: Provide fiberglass manhole ladders
2/21/07: Fire Alarm system record drawing information.
2/21/07: Socket Meter additional feature descriptions.