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**To:** Prospective Bidders  
**From:** Wold Architects and Engineers  
**Date:** March 2, 2016  
**Comm. No:** 133030

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**Subject:** Addendum No. 4 for Bidding Documents for the: **Scott County Sheriff Patrol Headquarters**

**BIDS DUE MARCH 7, 2016 AT 1:00 P.M.**

This addendum forms a part of the Contract Documents dated February 8, 2016. Acknowledge receipt of this Addendum on the space provided on the Bid Form. Failure to do so may result in disqualification of Bid.

This Addendum consists of one (1) typed sheet and the following attachments:

Project Manual: 01 11 00 Summary of Work, 03 41 00 Precast Structural Concrete, 23 07 00 HVAC Insulation  
Drawings: M3.05, E0.1, E6.0, E8.1

**PROJECT MANUAL**

1. **SECTION 01 11 00 SUMMARY OF WORK**
  - A. Reissued this Addendum.
  
2. **SECTION 03 41 00 – PRECAST STRUCTURAL CONCRETE**
  - A. Reissued this Addendum.
  
3. **SECTION 23 07 00 – HVAC INSULATION**
  - A. Reissued this Addendum.

**DRAWINGS**

1. **SHEET M3.05 – MECHANICAL SCHEDULES**
  - A. Reissued this Addendum.
  
2. **SHEET E0.1 – ELECTRICAL SITE PLAN**
  - A. Reissued this Addendum.
  
3. **SHEET E6.0 – RISER DIAGRAM**
  - A. Reissued this Addendum.
  
4. **SHEET E8.1 – ELECTRICAL DETAILS**
  - A. Reissued this Addendum.

**END OF ADDENDUM #4**

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## SECTION 01 11 00

### SUMMARY OF THE WORK

#### PART 1: GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

##### 1.02 SUMMARY

- A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Work phases.
3. Work under other contracts.
4. Use of premises.
5. Owner's occupancy requirements.
6. Punchlist Completion.
7. Work restrictions.
8. Specification formats and conventions.

- B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

##### 1.03 PROJECT IDENTIFICATION

- A. Project Name: Scott County Sheriff Patrol Headquarters, Eldridge, Iowa
- B. Owner: Scott County  
600 West Fourth Street  
Davenport, Iowa 52801-1030
1. Owner's Project Coordinator: Tammy Speidel  
600 West Fourth Street  
Davenport, Iowa 52801-1030
- C. Architect: Wold Architects and Engineers  
110 North Brockway, Suite 220,  
Palatine, Illinois, 60067
- C. Civil Engineer: Verbeke-Meyer Consulting Engineers, P.C.  
4111 East 60<sup>th</sup> Street  
Davenport, Iowa 52807
- D. Structural Engineer: Johnson Wilber Adams, Inc.  
175 N Washington Street  
Wheaton, Illinois 60187
- E. Mechanical Engineer: Wold Architects and Engineers  
110 North Brockway, Suite 220,  
Palatine, Illinois, 60067

F. Electrical Engineer:

Wold Architects and Engineers  
110 North Brockway, Suite 220,  
Palatine, Illinois, 60067

#### **1.04 SUMMARY OF THE WORK**

Briefly and without force and effect upon the Contract Documents, the Work of this single prime Contract can be summarized as follows:

A. Work under this Contract includes:

1. Sitework
  - a. Site utilities: Water mains, storm sewers, sanitary sewers.
  - b. Rough and finish grading, paving, concrete sidewalks and plazas, ground cover, trees and shrubs.
  - c. Fencing, garbage/generator enclosure, and miscellaneous site improvements.
2. Building Structure
  - a. Concrete footings, concrete foundation walls, concrete slabs on grade, masonry bearing walls, steel framing, steel bar joist/deck roof systems, composite steel/concrete roof systems, insulated steel stud exterior bearing wall systems, and miscellaneous metal items.
3. Building Enclosure
  - a. Exterior wall systems of face brick, cavity wall insulation, manufactured metal wall panels.
  - b. Aluminum windows, curtainwall, storefront entrance systems and glazing. Galvanized hollow metal doors and frames. Aluminum louvers.
  - c. Roofing systems of fully adhered single ply, pre-finished metal coping.
4. Interior Finishes
  - a. Insulated gypsum board/metal stud partitions, concrete block partitions.
  - b. Floor finishes of carpet, LVT, porcelain tile, sealed concrete.
  - c. Wall finishes of paint, vinyl wallcovering, porcelain tile.
  - d. Ceiling finishes of acoustical lay-in tile, gypsum board, gypsum board soffits.
  - e. Plastic laminate casework, HM doors and frames, wood doors, access panels, hardware, glazing, lockers, toilet partitions, toilet accessories, markerboards, signage, miscellaneous specialties.
5. Mechanical Systems
  - a. Plumbing including, supply and waste piping systems, piping insulation, plumbing fixtures.
  - b. Heating including piping, piping insulation, boilers, heat pumps, and geothermal well field.
  - c. Ventilation to include, air handlers, ductwork, duct insulation, and chilled water piping.
  - d. Temperature control system.

6. Electrical Systems
  - a. Electrical service, switchgear, generator, distribution panels, conduit and wiring.
  - b. Interior and exterior lighting. Parking lot lighting.
  - c. Data and Communications – Communications rough-in infrastructure for telephone, intercom and security systems by Owner. Projectors, cameras, and vestibule intercom by Electrical Contractor. Data racks by Owner, and cable tray by Electrical Contractor.
  - d. Fire alarm system.
  - e. Provide fiber line from corner of Veteran’s Way and Blackhawk Trail Road to new Patrol Headquarters. Also, provide fiber line to existing secondary roads building.
7. Keep Architect fully informed about progress of the work, performance of the work and potential problems.
8. The Owner will hold a ground breaking at the start of construction. The Contractor is responsible to supply 20 new hard hats and 20 new shovels for the participants.

### **1.05 WORK PHASES**

- A. Start work immediately upon contract award by the County Board.

### **1.06 WORK UNDER OTHER CONTRACTS**

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
  1. Low Voltage cabling
    - a. Data wiring
    - b. Telephone wiring
    - c. Security system wiring
- C. Future Work: Owner will award separate contract(s) for the following additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
  1. Low voltage cabling to include:
    - a. Data wiring
    - b. Telephone wiring
    - c. Security system wiring
  2. Furnishings and movable equipment

### **1.07 USE OF PREMISES**

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor’s use of premises is limited only by Owner’s right to perform work or to retain other contractors on portions of Project.

1. Contractor is to visit site and be familiar with existing conditions. Contractor will be required to accept existing conditions on site prior to mobilizing.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Allow for Owner occupancy of Project site and use by the public.
  2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  3. Public Streets: Maintain clear of automobile parking, equipment or material storage unless arrangements have been made with the appropriate jurisdiction.
  4. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.
- C. Do not allow construction waste and debris to accumulate; remove debris as it accumulates and, unless specified otherwise, dispose of legally off-site.
- D. Conform to City's noise control regulations, including limited hours of construction operations.

#### **1.09 LAYING OUT WORK**

- A. Locate all general reference points. Where dimensions or observed scope of work differ substantially from Drawings, notify Architect for decision. *The Contractor is responsible for surveying and staking out all construction and building points, and locating the building. Additional general reference points will be issued as needed after award of contract.*
- B. Lay out Work from the reference points furnished and be responsible for all lines, elevations, and measurements inside workspace. Exercise proper precaution to verify figures shown on Drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.
- C. Hire the services of a locator company to locate all privately owned utilities that may be disturbed by construction operations.
- D. Coordinate utility connections with municipality/utility company in which project is being constructed.

#### **1.10 OWNER'S OCCUPANCY REQUIREMENTS**

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a punchlist for each specific portion of the Work to be occupied before Owner move in.
  2. Obtain a temporary Certificate of Occupancy if required from authorities having jurisdiction before Owner occupancy to install furnishings and equipment.

## **1.11 WORK RESTRICTIONS**

- A. The Contractor shall limit access to grounds as indicated on Civil Drawings.
- B. The Contractor's access to and use of the site/facility for completion of work shall be subject to the following:
  - 1. Should the Contractor have additional work to complete after April 28, 2017 including punchlist work within the existing building, continuous use of facilities is required by the Owner during regular business hours of 7:30 a.m. to 5:30 p.m. Work in those areas shall occur during evenings and weekends and shall be cleaned and available for use the following business day unless otherwise authorized by the Owner.
  - 2. Should the Contractor choose to perform work after normal business hours when the building is occupied, the Contractor shall:
    - a. Maintain access, building utilities, and services to allow full and free use of the facility during this time. All temporary conditions, re-routing of services, utilities and/or power are the Contractor's responsibility.
    - b. Coordinate access and storage of materials and equipment with the Owner's designated building representative. To the fullest extent possible provide for normal building operation, and the safety of the building's occupants. Work in areas that occur during evenings and weekends shall be cleaned and available for use the following business day.
    - c. Coordinate schedule with the Owner's designated building representative.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than seven (7) days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's or Owner's permission.

## **1.12 SPECIFICATION FORMATS AND CONVENTIONS**

- A. Specification Format: The Specifications are organized into Division and Sections using the 49-division format and CSI/CSC's "Master Format" numbering system.
  - 1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (: ) is used within a sentence or phrase.

**END OF SECTION 01 11 00**

## SECTION 03 4100

### PRECAST STRUCTURAL CONCRETE

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

##### 1.02 SECTION INCLUDES

- A. Spandrels.
- B. Wall panels
- C. Grout packing.

##### 1.03 RELATED SECTIONS

- A. Section 01 4533 - Structural Testing And Special Inspection
- B. Section 03 2100 - Concrete Reinforcement
- C. Section 03 3000 - Cast-in-Place Concrete

##### 1.04 REFERENCE STANDARDS

- A. ACI 301-10 - Specifications for Structural Concrete for Buildings; 2010
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.
- C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- D. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- E. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2002
- F. ASTM A 416/A 416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete; 2006.
- G. ASTM A496 - Steel Welded Wire Reinforcement, Deformed, for Concrete; 2002
- H. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- I. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.
- J. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel; 1998el
- K. ASTM B766 - Electrodeposited Coatings of Cadmium; 2003
- L. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- M. ASTM C881 - Epoxy-Resin-Base Bonding Systems for Concrete; 2002
- N. ASTM F1554 - Anchor Bolts, Steel 36, 55, and 105-ksi Yield Strength; 1999
- O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2008.
- P. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.
- Q. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; Precast/Prestressed Concrete Institute; 1999, Fourth Edition.

- R. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; Sixth Edition, 2004.
- S. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1988, Second Edition.
- T. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute; 2000.
- U. International Building Code (IBC) - 2009

#### **1.05 DESIGN REQUIREMENTS**

- A. Conform to ACI 318 and MSBC for design load and construction requirements applicable to work of this section.
- B. Design components to withstand dead loads and design loads in the configuration indicated on the drawings and as follows:
  - 1. Maximum Allowable Wind Load Deflection of Wall Assemblies:  $1/240$  span.
  - 2. Calculate structural properties of framing members in accordance with ACI 318.
- C. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

#### **1.06 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a pre-installation conference one week prior to commencing work of this section.
  - 1. Instruct others when field cutting is required for openings that are 8 inches and smaller.
  - 2. Discuss limitations, if any, on field cutting of openings.
- B. Design loadings shall include initial handling and erection conditions and all dead, wind, and live loads specified on the contract documents including partition weights given on the Drawings. Precast supplier shall review architectural and structural drawings to verify adequacy of precast members supporting partitions and other non-structural elements near openings, at edges, etc.
- C. Design deviations will be permitted only with written approval of the Engineer. Any proposed deviations must include complete design calculations and drawings.

#### **1.07 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings
  - 1. Erection drawings: Include member piece marks with size and shape of each member; plans/elevations showing all products furnished by supplier; sections/details showing connections and cast in items; joints and openings between members and structure; description of all loose cast-in field hardware; locations of field installed anchors, fire ratings of all members; and all dead, live and other applicable design loads.
  - 2. Include anticipated camber and deflection of precast members where camber or deflection exceeds  $L/360$  or  $1/2"$ , and where camber and deflection vary more than  $1/4"$  between adjacent units.
  - 3. Production drawings on request. Include elevation view of each member, sections/details to show quantity and position of reinforcing, anchors, and inserts, handling devices, dimensions and finished, strand prestress, concrete strength, and estimated camber.
- C. Calculations
  - 1. Submit calculations for wall panels, spandrels, and connections.
  - 2. Review of calculations shall be for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Contractor remains responsible for



correctness and completeness of submitted calculations.

3. Calculations to be certified by a professional engineer licensed in the State in which the Project is located.
- D. Submit sufficient evidence to the Structural Engineer, on request, that all persons performing shop and field welding are currently certified by AWS for the procedures they are performing.
- E. Precast plant certification on request.

#### **1.09 QUALITY ASSURANCE**

- A. Designer Qualifications: Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.
- B. The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute, Plant Certification Program, in categories *C1A or C3A and C4A*, at the time of bidding.
- C. Perform work of this section in accordance with requirements of PCI MNL-116, PCI MNL-120, PCI MNL-123, and PCI MNL-135.
- D. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- E. Erector Qualifications: Company specializing in erecting products of this section with minimum 5 years of experience.
- F. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.
- B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
- C. Protect members to prevent staining, chipping, or spalling of concrete.
- D. Mark each member with date of production and final position in structure.
- E. Storage:
  1. Store all units off ground. Place stored units so the identification marks are discernible.
  2. Separate stacked members by battens across full width of each bearing points.
  3. Stack so that lifting devices are accessible and undamaged. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

#### **1.11 PROJECT CONDITIONS**

- A. Coordinate the work of framing components not pre-tensioned but associated with the work of this section.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Cement: Gray portland type, conforming to ASTM C 150, Type I.
- B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116.
- C. Fly ash: ASTM C618, type C or F. Use only on precast members not exposed to view with Architect/Engineer's approval.

## 2.02 REINFORCEMENT

- A. Tensioning Steel Tendons: ASTM A 416/A 416M, Grade 250 (1725); seven-wire stranded steel cable; low-relaxation type; full length without splices; uncoated.
- B. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
  - 1. Deformed billet-steel bars.
- C. Steel Welded Wire Reinforcement: ASTM A 185/A 185M plain type or ASTM A 497/A 497M deformed type; in flat sheets; unfinished.

## 2.03 ACCESSORIES

- A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, and inserts conforming to PCI MNL-123, and as follows:
  - 1. Structural Steel Material: Carbon steel conforming to ASTM A 36/A 36M, or ASTM A500 Grade B..
  - 2. Anchor Bolts: ASTM F1554
  - 3. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.
  - 4. Welded headed studs: AWS D1.1-Type B
  - 5. Deformed bar anchors: ASTM ASTM A496
  - 6. Welding electrodes: E70XX
  - 7. Interior Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.
- B. Grout:
  - 1. Non-shrink, non-metallic, minimum compressive strength of 10,000 psi at 28 days.
  - 2. Epoxy-Resin Grout: Two components mineral-filled epoxy-resin: ASTM C881.
- C. Bearing Pads
  - 1. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer. Capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting or delaminating in the internal portions of the pad. Masticord: JVI ([www.jvi-inc.com](http://www.jvi-inc.com)) or approved equal.
  - 2. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, 50 to 70 Shore A durometer per ASTM D 2240, minimum tensile strength 2250 psi per ASTM D 412..
- D. Insulation: Manufacturer's standard extruded polystyrene to achieve a wall R-value of 15 or greater – R-Value of 5 per inch minimum *for 3 inches of insulation in wall panel (see Detail of Construction 31019).*
- E. Wydth Connectors: Delta Ties by Dayton Superior *or equal.*
- E. Prime Paint: Zinc rich alkyd type.

## 2.04 FABRICATION

- A. Conform to fabrication procedures specified in PCI MNL-116.
- B. Maintain plant records and quality control program during production of precast members. Make records available upon request.
- C. Ensure reinforcing steel, strands, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on Drawings. Keep strands or wires clean of substances harmful to bonding of strand to concrete.
- D. Tension reinforcement tendons as required to achieve design load criteria.

- E. Provide required openings with a dimension larger than 8 inches and embed accessories provided under other sections of the specifications, at indicated locations.
- F. Exposed Ends at Stressing Tendons: Fill recess with non-shrink grout, trowel flush.
- G. Provide AWS certified welders for all shop welding.
- H. Wall Panels:
  - 1. Exterior: Provide reveal recesses and joints as shown on the Drawings. See Drawings for color and texture.
  - 2. When openings in precast panels are shown on drawings, provide color and finish throughout depth of panel at all sides of opening as indicated.
  - 3. Coordinate electrical device location rough-in with Electrical Contractor.
- I. Panel Identification:
  - 1. Mark each precast panel to correspond to identification mark on shop drawings for panel location.
  - 2. Mark each precast panel with date cast.

## **2.05 FINISHES**

- A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.
- B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- C. Finish members to PCI MNL-116 Standard grade.
- E. Exposed-to-View Finish at interior of Garage: Grade A finish – Surface holes or bubbles over 1/4 inch filled with matching cementitious paste, fins or protrusions removed and surface ground smooth.
- F. Power Trowel Finish: Smooth steel-trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth, uniform finish. Surface to be painted or have tile installed – see Room Finish Schedule for finishes.

## **2.06 FABRICATION TOLERANCES**

- A. Conform to fabrication tolerances specified in PCI MNL-135.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that site conditions are ready to receive work and field measurements are as shown on Drawings.
- B. Verify that supporting structure is ready to receive work, including all bearing surfaces, location and alignment of inserts and anchorage items cast in the structure.
- C. Notify the General Contractor in writing of required corrections, if unsatisfactory conditions or deficiencies are observed. Do not begin work until corrections are made

### **3.02 ERECTION**

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Align and maintain uniform horizontal and vertical joints, as erection progresses.
- C. Maintain temporary bracing in place until final support is provided. Protect members from staining.
- D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.
- E. Adjust differential camber between precast members to tolerance before final attachment.

- F. Install bearing pads.
- G. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.
- H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.
- I. Secure units in place. Perform welding in accordance with AWS D1.1.
- J. Cooperate with other trades in permitting insertion of anchors, hangers, electrical outlets, etc.
- K. Remove erection devices or cut off flush with the surface of the member.

### **3.03 TOLERANCES**

- A. Erect members level and plumb within allowable tolerances.
- B. Conform to PCI MNL-135 for erection tolerances.
- C. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise Architect. Execute modifications as directed.

### **3.04 FIELD OPENINGS AND ANCHORS BY OTHER TRADES**

- A. Field cut openings smaller than 8" in all directions using power saws or core drills. Receive written approval of opening locations by the precast prestressed manufacturer and Architect before cutting. Repair all unsightly spalls or chips caused by cutting.
- B. Receive approval of type and location of field installed fasteners from precast prestressed manufacturer and Architect. Anchors shall not contact prestressing steel.

### **3.05 FIELD QUALITY CONTROL**

- A. Structural Testing and Special Inspection
  - 1. Comply with the requirements of Section 05 1200 - Structural metal Framing.
  - 2. The Owner will employ a Special Inspector for the following:
    - a. Visually inspect welds connecting embeds to structural steel supporting members.
    - b. Visually inspect welds at all connections between precast members.

### **3.06 PROTECTION**

- A. Protect members from damage caused by field welding or erection operations.

### **3.07 CLEANING**

- A. Clean weld marks, dirt, or blemishes from surface of exposed members.
- B. Clean and prime exposed steel and welds immediately after erection.

**END OF SECTION**

## SECTION 23 07 00

### HVAC INSULATION

#### PART 1: GENERAL

##### 1.01 RELATED DOCUMENTS

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

##### 1.02 SUMMARY

- A. Section Includes:

- 1. Insulation Materials:
  - a. Flexible elastomeric.
  - b. Mineral fiber.
- 2. Fire-rated insulation systems.
- 3. Insulating cements.
- 4. Adhesives.
- 5. Mastics.
- 6. Lagging adhesives.
- 7. Sealants.
- 8. Factory-applied jackets.
- 9. Field-applied jackets.
- 10. Tapes.
- 11. Securements.
- 12. Corner angles.

- B. Related Sections:

- 1. Division 22 Section "Plumbing Insulation."
- 2. Division 23 Section "Ductwork" for duct liners.

##### 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

- B. Shop Drawings:

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
- 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
- 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
- 4. Detail application of field-applied jackets.
- 5. Detail application at linkages of control devices.
- 6. Detail field application for each equipment type.

- C. Qualification Data: For qualified Installer.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### **1.06 COORDINATION**

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### **1.07 SCHEDULING**

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### **PART 2: PRODUCTS**

#### **2.01 INSULATION MATERIALS**

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Flexible Elastomeric (FE): Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials; thermal conductivity (avg) of 0.27 Btu/hr-ft<sup>2</sup>-°F or lower at mean temperature of 75°F; 3.0 lbs./ft<sup>3</sup> density (ASTM D/622); 0.08 perm-in permeability (ASTM E96); 0.2% water absorption (ASTM C209).
- G. Mineral-Fiber Blanket Insulation (MF): Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I; thermal conductivity (avg) of 0.27 Btu/hr-ft<sup>2</sup>-°F or lower at mean temperature of 75°F. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Refer to Part 3 below for insulation density.
- H. Rigid Fiberglass Ductwork Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type 1, 3.0 lb./cu. ft. density for up to 450°F. Service shall meet or exceed ASTM C 680 thermal conductivity test of .23 BTU-in/hr-ft<sup>2</sup> - °F at 75°F mean temperature. Provide with factory applied FSK jacket.
- I. Mineral-Fiber, Preformed Pipe Insulation (MF): Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL; thermal conductivity (avg) of 0.25 Btu/hr-ft<sup>2</sup>-°F or lower at mean temperature of 75°F. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Mineral-Fiber, Pipe and Tank Insulation (MF): Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 3.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.02 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6 tested and certified to provide a 1-hour fire rating by a NRTL acceptable to authority having jurisdiction.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by a NRTL acceptable to authority having jurisdiction.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; FlameChek.
    - b. Johns Manville; Firetemp Wrap.
    - c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
    - d. Thermal Ceramics; FireMaster Duct Wrap.
    - e. 3M; Fire Barrier Wrap Products.

## 2.03 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

## 2.04 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.

## **2.05 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 200 deg F.
  - 3. Solids Content: 63 percent by volume and 73 percent by weight.
  - 4. Color: White.

## **2.06 LAGGING ADHESIVES**

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
  - 2. Service Temperature Range: Minus 50 to plus 180 deg F.
  - 3. Color: White.

## **2.07 SEALANTS**

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:



1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

## **2.08 FACTORY-APPLIED JACKETS**

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II. Vapor retarder shall be rated for 150°F service, ASTM E 96 vapor permeance rated at 0.02 perms., for applications where systems operate above ambient temperatures or where a vapor retarder is not required.

## **2.09 FIELD-APPLIED JACKETS**

- A. Field-applied jackets shall comply with ASTM C 921, as follows:
1. Shall comply with ASTM C921, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.
  2. Shall comply with ASTM C921, Type II, for applications where systems operate above ambient temperatures or where a vapor retarder is not required.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
  2. Color: White.
  3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  4. Factory-fabricated tank heads and tank side panels.
- C. Fitting Covers:
1. PVC Jacket: One or two piece pre-molded high impact PVC fitting covers with fiberglass inserts and accessories. Covers shall be UV resistant and comply with ASTM 1784-92. Covers shall be sized to comply with insulation applications detailed in Part 3.0.

- a. Below ambient systems: provide continuous vapor barrier in accordance with manufacturer recommendations.
- b. Fiberglass Inserts: Thermal conductivity (ASTM C177), thermal conductivity average of 0.26 Btu/hr-ft<sup>2</sup>-°F or lower at a mean temperature of 75 °F.

D. Metal Jacket:

- 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
  - a. Factory cut and rolled to size.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick Polysurlyn.
  - d. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

**2.10 TAPES**

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 11.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 6.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  - 1. Width: 2 inches.
  - 2. Thickness: 6 mils.
  - 3. Adhesion: 64 ounces force/inch in width.
  - 4. Elongation: 500 percent.
  - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Width: 2 inches.
  - 2. Thickness: 3.7 mils.
  - 3. Adhesion: 100 ounces force/inch in width.
  - 4. Elongation: 5 percent.
  - 5. Tensile Strength: 34 lbf/inch in width.

## 2.11 SECUREMENTS

- A. Bands:
  - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch wide with wing seal.
  - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch wide with wing seal.
- B. Insulation Pins and Hangers:
  - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.
  - 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  - 4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

## **2.12 CORNER ANGLES**

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

## **PART 3: EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.03 PIPING INSULATION APPLICATION**

- A. Indoor Piping System Insulation: Insulate with insulation types and thicknesses as listed in the table below. If more than one pipe material is listed for a piping system, selection from materials listed is the contractor's option.

**TABLE NO. 23 07 00: MINIMUM PIPE INSULATION**

| Piping System Types                       | Fluid Temp Range, °F        | Type of <sup>(1)</sup> Insulation | Insulation Thickness in Inches for Pipe Sizes |              |              |          |               |
|---|-----------------------------|-----------------------------------|---|--------------|--------------|----------|---------------|
|   |                             |                                   | 3/4" and Smaller                              | 1" to 1 1/4" | 1 1/2" to 3" | 4" to 6" | 8" and Larger |
| <u>Conditioned Spaces</u>                 |                             |                                   |   |              |              |          |               |
| Heating Water <sup>(6)</sup>              | 105-200                     | MF                                | 1 1/2"  | 1 1/2"       | 2"           | 2"       | 2"            |
| Chilled Water <sup>(2)(3)</sup>           | Greater than or equal to 40 | FE                                | 1/2"  | 1/2"         | 1"           | 1"       | 1"            |
| Geothermal Water <sup>(2)(3)</sup>        | Any                         | FE                                | 1/2"  | 1"           | 1"           | 1"       | 1 1/2"        |
| Make-Up Water                             | Any                         | MF, FE                            | 1/2"  | 1/2"         | 1"           | -        | -             |
| Condensate Drains                         | Any                         | FE                                | 1/2"  | 1"           | 1"           | -        | -             |
| Refrigerant (Suction)                     | 40-55                       | FE                                | 1/2"  | 1/2"         | 1"           | 1"       | -             |
| Refrigerant (Hot Gas) <sup>(4)</sup>      | Up to 140                   | MF                                | 1"  | 1"           | 1 1/2"       | -        | -             |
| <u>Unconditioned Spaces<sup>(5)</sup></u> |                             |                                   |   |              |              |          |               |
| Chilled Water <sup>(2)(3)</sup>           | Greater than or equal to 40 | FE                                | 1"  | 1"           | 1 1/2"       | 1 1/2"   | 1 1/2"        |
| Geothermal Water <sup>(2)(3)</sup>        | Any                         | FE                                | 1"  | 1 1/2"       | 1 1/2"       | 1 1/2"   | 2"            |
| Refrigerant (Suction)                     | 40-55                       | FE                                | 1"  | 1"           | 1 1/2"       | 1 1/2"   | -             |

<sup>1</sup> Insulation material abbreviations:

- a. Mineral fiber (MF) – with factory applied jacket per part 2.0 requirements.
- b. Flexible Elastomeric (FE)

<sup>2</sup> Provide flexible elastomeric cellular insulation at valves and fittings. Refer to drawings for installation details.

<sup>3</sup> Provide two layers of insulation for thickness 1 1/2" and greater. Longitudinal seams shall be offset to ensure a continuous vapor barrier.

<sup>4</sup> Insulation not required outside of the building.

<sup>5</sup> Unconditioned spaces shall include all systems indicated located in mechanical rooms, vehicle storage garages, and outside the building envelope.

<sup>6</sup> For hot water piping smaller than 1 1/2" and located in partitions within conditioned spaces, reduction of these thicknesses by 1" shall be permitted, but not to thicknesses below 1".

B. Refer to Division 23 Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for insulation insert and insulation shield requirements.

C. Insulation Omitted: Omit insulation for the following:

1. Heating water piping within radiation enclosures or unit cabinets.
2. Chilled water and geothermal water piping within unit cabinets provided piping is located over drain pan.

### 3.04 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply (unless otherwise noted) and outdoor air.
3. Indoor, concealed return located in nonconditioned space. This includes ducted returns above a non-plenum ceiling. Return ducts in a return air plenum do not require insulation.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed exhaust and relief between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust and relief between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.

3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

### **3.05 INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Concealed, supply-air duct and plenum insulation:
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft nominal density.
- B. Concealed, return-air duct and plenum insulation; non-conditioned areas including ducted returns in a non-plenum ceiling (insulation not required in return air ceiling plenums or in chases or shafts within the conditioned building perimeter):
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft nominal density.
- C. Concealed, outdoor air duct and plenum insulation:
  1. Mineral-Fiber Blanket: 2 inches thick and 1.0-lb/cu. ft nominal density.
- D. Concealed, exhaust-air and relief-air duct and plenum insulation (within 10 feet of exterior wall or roof):
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft nominal density.
- E. Exposed, supply-air duct and plenum insulation (insulation not required on exposed ductwork within a conditioned space, i.e. Vehicle Storage Garage) (*all supply air ducts associated with AHU-2 shall be insulated, including those located within a conditioned space*):
  1. Mineral-Fiber Board: 2 inches thick and 3.0-lb/cu. ft nominal density.
- F. Exposed, return-air duct and plenum insulation, non-conditioned areas:
  1. Mineral-Fiber Board: 2 inches thick and 3.0-lb/cu. ft nominal density.
- G. Exposed, outdoor air duct and plenum insulation:
  1. Mineral-Fiberboard: 2 inches thick and 3.0-lb/cu.ft. nominal density.
  2. Mineral-Fiberblanket: 2 inches thick and 1.5 lb/cu.ft nominal density. For round ducts only.
- H. Exposed, exhaust-air and relief-air duct and plenum insulation:
  1. Mineral-Fiber Board: 2 inches thick and 3.0-lb/cu. ft nominal density.

### **3.06 EQUIPMENT INSULATION SCHEDULE**

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Chilled-water and geothermal water pump insulation shall be:
  1. Flexible Elastomeric: 1 inch thick.
- D. Heating-hot-water pump insulation shall be:
  1. Mineral Fiber Board: 3.0 inches thick.

E. Chilled and geothermal water expansion and buffer tank insulation shall be:

1. Flexible Elastomeric: 1 inch thick.

F. Heating-hot-water expansion and buffer tank insulation shall be:

1. Mineral-Fiber Pipe and Tank: 1 inch thick.

G. Chilled-water and geothermal water air-separator insulation shall be:

1. Flexible Elastomeric: 1 inch thick.

H. Heating-hot-water air-separator insulation shall be:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

### **3.07 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  1. Install insulation continuously through hangers and around anchor attachments.
  2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

- K. For all insulation, seal. Exposed fiberglass including cut pre-formed pipe sections with manufacturer's approved mastic.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### **3.08 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.



- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Comply with requirements in Division 07 Section "Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Pipe: Install insulation continuously through floor penetrations.
  - 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Firestopping."

### **3.09 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION**

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  - 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  - 3. Protect exposed corners with secured corner angles.
  - 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

- c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
  - d. Do not overcompress insulation during installation.
  - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
  - f. Impale insulation over anchor pins and attach speed washers.
  - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
  7. Stagger joints between insulation layers at least 3 inches.
  8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
  9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
  10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
  2. Seal longitudinal seams and end joints.

### **3.10 GENERAL PIPE INSULATION INSTALLATION**

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Fiberglass inserts with PVC fitting covers are acceptable. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- E. Provide 16 gauge galvanized sheet metal insulation shields at all hanger locations. Shields shall be a minimum of 12" in length and formed to fit pipe contour.

### **3.11 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.12 MINERAL-FIBER INSULATION INSTALLATION**

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.

- f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### **3.13 FIELD-APPLIED JACKET INSTALLATION**

- A. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### **3.14 FIRE-RATED INSULATION SYSTEM INSTALLATION**

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Firestopping."

### **3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Outdoor Piping:

1. Aluminum, Smooth with Z-Shaped Locking Seam, 0.032 inch thick.

**END OF SECTION 23 07 00**



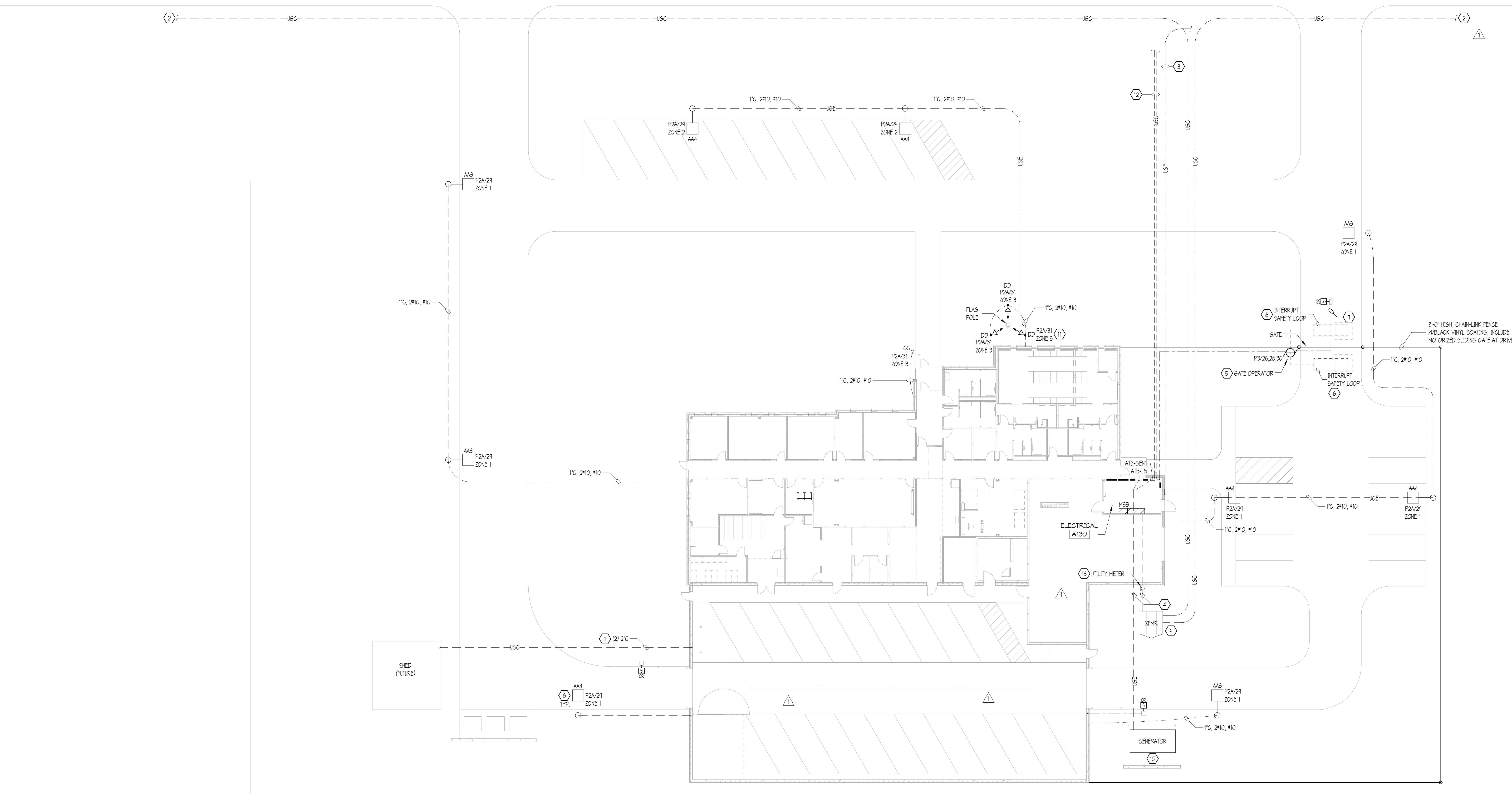




- GENERAL SHEET NOTES**
- ALL LIGHTING AND POWER CONDUCTORS SHALL BE INSTALLED BETWEEN 24" (MINIMUM) AND 36" (MAXIMUM) BELOW FINISHED GRADE.
  - ALL COMMUNICATIONS CONDUIT AND CABLES SHALL BE INSTALLED 36" (MINIMUM) BELOW FINISHED GRADE.
  - ALL CONDUCTORS FOR EXTERIOR LIGHTING AND POWER CIRCUITS SHALL BE #10 AWG MINIMUM.
  - REFER TO E1.0 FOR BUILDING MOUNTED LIGHTS.
  - REFER TO E4.0 FOR BUILDING MOUNTED SECURITY CAMERAS.

- KEYED SHEET NOTES**
- PROVIDE (2) 2" UNDERGROUND CONDUIT STUBBED UP FOR FUTURE SHED. ROUTE CONDUIT BACK TO ALSO ELECTRICAL.
  - PROVIDE 4" SCHEDULE 40 P.V.C UNDERGROUND CONDUIT FOR PRIMARY UTILITY CABLING. PRIMARY CONDUCTORS BY UTILITY. ROUTE AS SHOWN. COORDINATE WITH UTILITY. SEE SHEET E2.0 FOR FIBER LAY-OUT.
  - SEE SHEET E4.0 FOR CONDUIT AND CONDUIT SIZING.
  - PROVIDE UNDERGROUND 3/4" CONDUIT AND #10 #10S CABLING TO POWER GATE OPERATOR PROVIDED BY OTHERS.
  - INTERMEDIATE SERVICE LOOP PROVIDED BY OTHERS. COORDINATE WITH OTHER TRADES.
  - PROVIDE 3/4" UNDERGROUND CONDUIT AND CABLING FROM BUILDING TO GATE OPERATOR AND TO GARD READER FOR CONTROLS PROVIDED BY OTHERS. BUTTON TO BE LOCATED ON ISLAND ON ROADWAY. COORDINATE LOCATION WITH CIVIL.
  - EXTERIOR LUMINAIRE ZONE CONTROL BY RELAY PANEL SHOWN ON SHEET E1.0. TYPICAL.
  - PROVIDE CONCRETE PAD FOR UTILITY TRANSFORMER. SEE DETAIL C1 ON SHEET E8.1 FOR MORE DETAIL. COORDINATE INSTALLATION WITH UTILITY.
  - PROVIDE 500W NATURAL GAS GENERATOR AND CONCRETE PAD. MINIMUM CONCRETE PAD SIZE TO BE 48" (W) X 12'12" (L) AND 6" (D). COORDINATE PAD REQUIREMENTS WITH GENERATOR MANUFACTURER.
  - PROVIDE FLOOD LIGHTS AND POINT AT 20' FLAG PROVIDED BY OTHERS. FLOOD LIGHTS SHALL BE 7' AWAY FROM POLE.
  - PROVIDE (2) 4" C STUBBED UP AT CURB FOR FUTURE CONNECTIONS. COORDINATE PLACEMENT WITH OWNER.
  - PROVIDE UTILITY METER BASE ON SIDE OF BUILDING. COORDINATE REQUIREMENTS WITH UTILITY.

16TH AVENUE



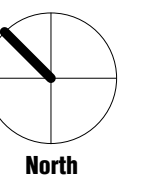
**H1 ELECTRICAL SITE PLAN**  
1/16" = 1'-0"

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed PROFESSIONAL ENGINEER

under the laws of the State of IOWA  
*Bradley R. Johannsen*  
BRADLEY R. JOHANNSEN  
Registration Number 18415 Date 2/2/16

| Description | Revisions | Date   | Num |
|-------------|-----------|--------|-----|
| ADDENDUM #2 |           | 2/2/16 | 1   |
| ADDENDUM #4 |           | 3/2/16 | 2   |
|             |           |        |     |
|             |           |        |     |

Comm: 133030  
Date: 2/2/16  
Drawn: A. NELSON  
Check: B. JOHANNSEN



**ELECTRICAL SITE  
PLAN**

Scale: As indicated

**Sheriff's Patrol  
Headquarters**

3206 South 16th Street  
Eldridge, Iowa, USA 52748

**Scott County**  
600 West Fourth Street  
Davenport, Iowa

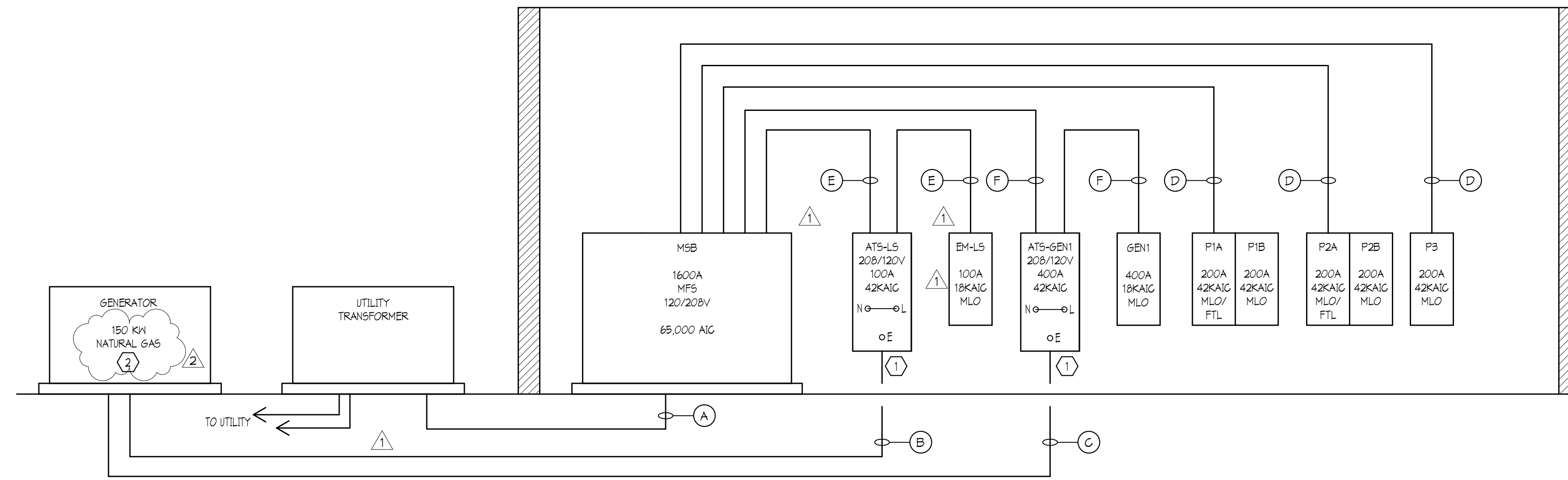


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**KEYED SHEET NOTES**

1. PROVIDE AUTOMATIC TRANSFER SWITCH AND CONNECT EMERGENCY LINE TO GENERATOR.
2. PROVIDE 1500V NATURAL GAS GENERATOR. COORDINATE WITH MECHANICAL ON INSTALLATION OF GAS LINES.



**C4 POWER RISER DIAGRAM**  
NOT TO SCALE

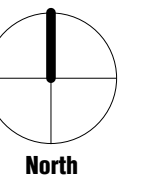
| FEEDER SCHEDULE    |                  |                     |                 |      |                                   |                 |                   |                |               |                  |           |            |                         |
|--------------------|------------------|---------------------|-----------------|------|-----------------------------------|-----------------|-------------------|----------------|---------------|------------------|-----------|------------|-------------------------|
| FEEDER INFORMATION |                  | CONDUIT INFORMATION |                 |      | PHASE, NEUTRAL, AND GND WIRE INFO |                 |                   |                |               | WIRE INFORMATION |           |            | CALCULATED VOLTAGE DROP |
| FEEDER NUMBER      | LOAD DESCRIPTION | SETS OF CONDUIT     | CONDUIT(S) SIZE | TYPE | P-N QUANTITY                      | PHASE WIRE SIZE | NEUTRAL WIRE SIZE | NEUTRAL S OR D | GND WIRE SIZE | SERVICE ENTRANCE | WIRE TYPE | WIRE INSUL |                         |
| A                  | 1600A            | 5                   | 3 1/2"          | EXTG | 4                                 | 400             | 400               | S              |               | X                | CU        | THHN       |                         |
| B                  | 100A GEN         | 1                   | 2 1/2"          | EXTG | 4                                 | 1               | 1                 | S              | 8             |                  | CU        | THHN       |                         |
| C                  | 400A GEN         | 2                   | 2 1/2"          | EXTG | 4                                 | 30              | 30                | S              | 2             |                  | CU        | THHN       |                         |
| D                  | 200A             | 1                   | 2"              | EMT  | 4                                 | 30              | 30                | S              | 6             |                  | CU        | THHN       |                         |
| E                  | 100A             | 1                   | 1 1/2"          | EMT  | 4                                 | 1               | 1                 | S              | 8             |                  | CU        | THHN       |                         |
| F                  | 400A             | 2                   | 2"              | EMT  | 4                                 | 30              | 30                | S              | 2             |                  | CU        | THHN       |                         |

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed PROFESSIONAL ENGINEER

under the laws of the State of IOWA  
  
 BRADLEY R. JOHANSEN  
 Registration Number 18475 Date 2/2/16

| Description | Revisions | Date   | Rev |
|-------------|-----------|--------|-----|
| APPENDUM #2 |           | 2/2/16 | 1   |
| APPENDUM #4 |           | 3/2/16 | 2   |

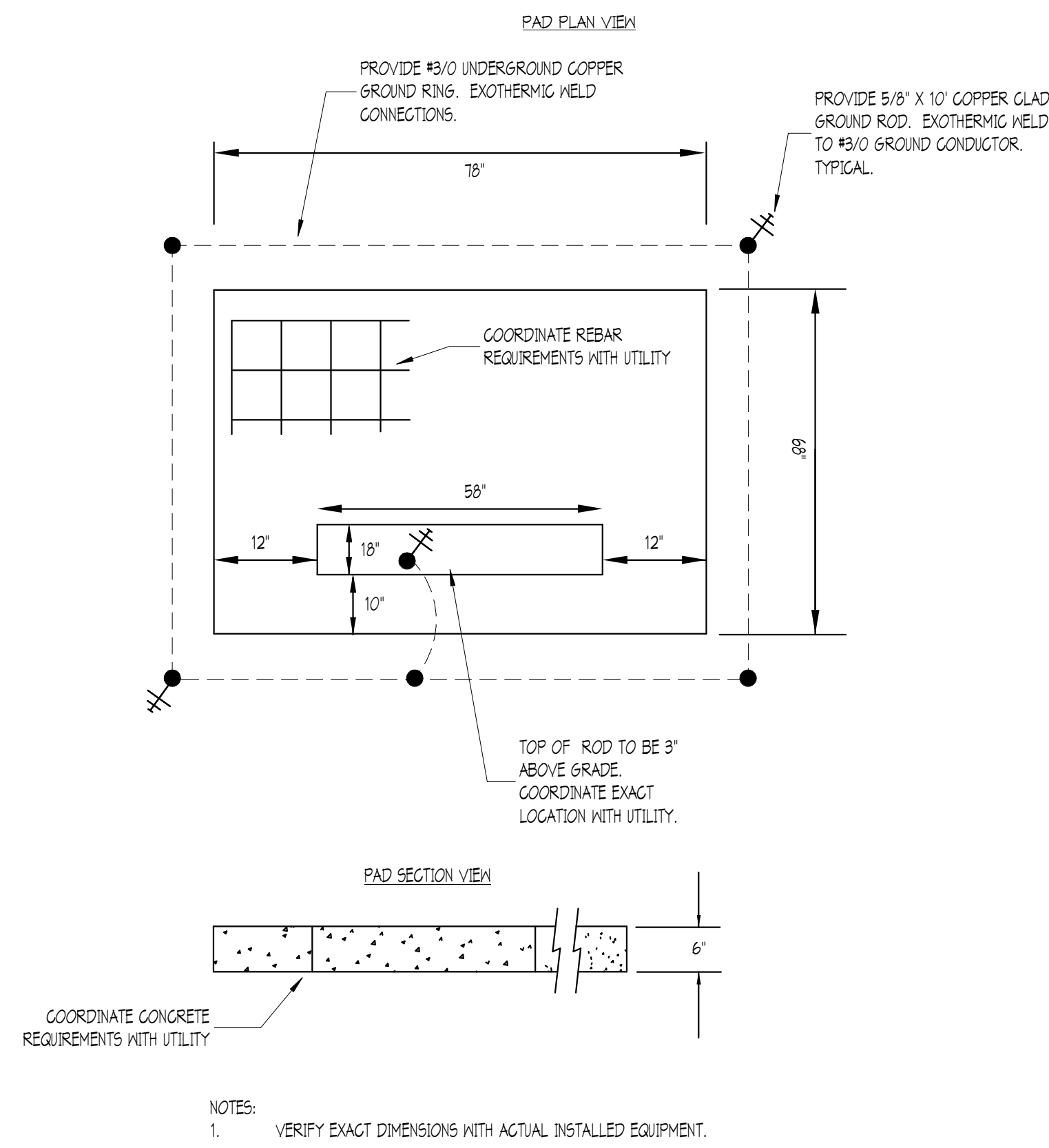
Comm: 133030  
 Date: 2/2/16  
 Drawn: A. NELSON  
 Check: B. JOHANSEN



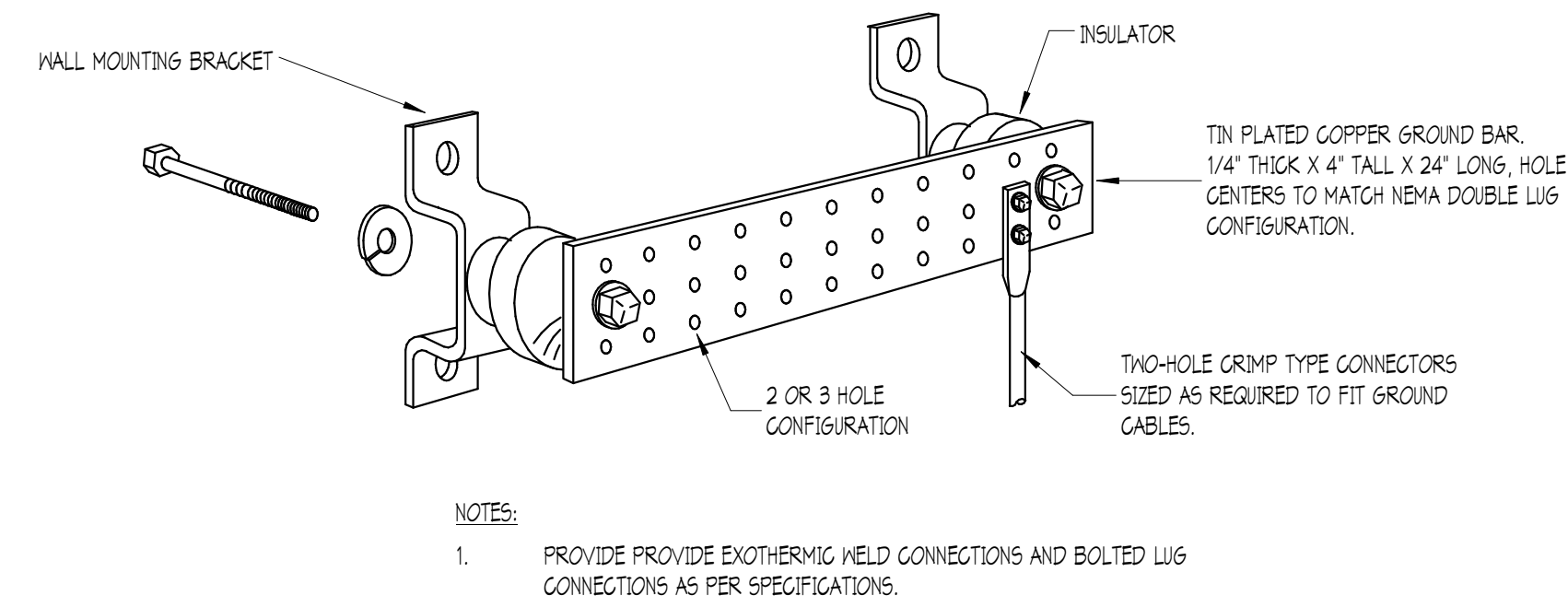
**RISER DIAGRAM**

Scale: As indicated

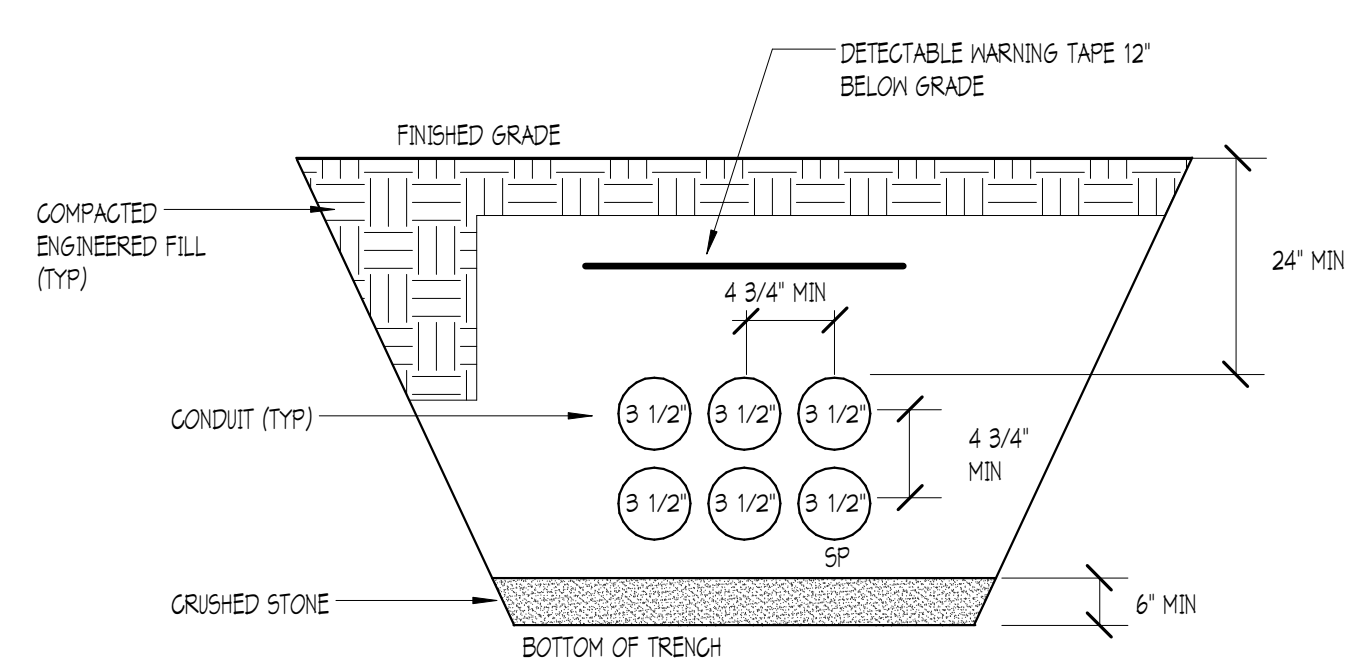
**E6.0**



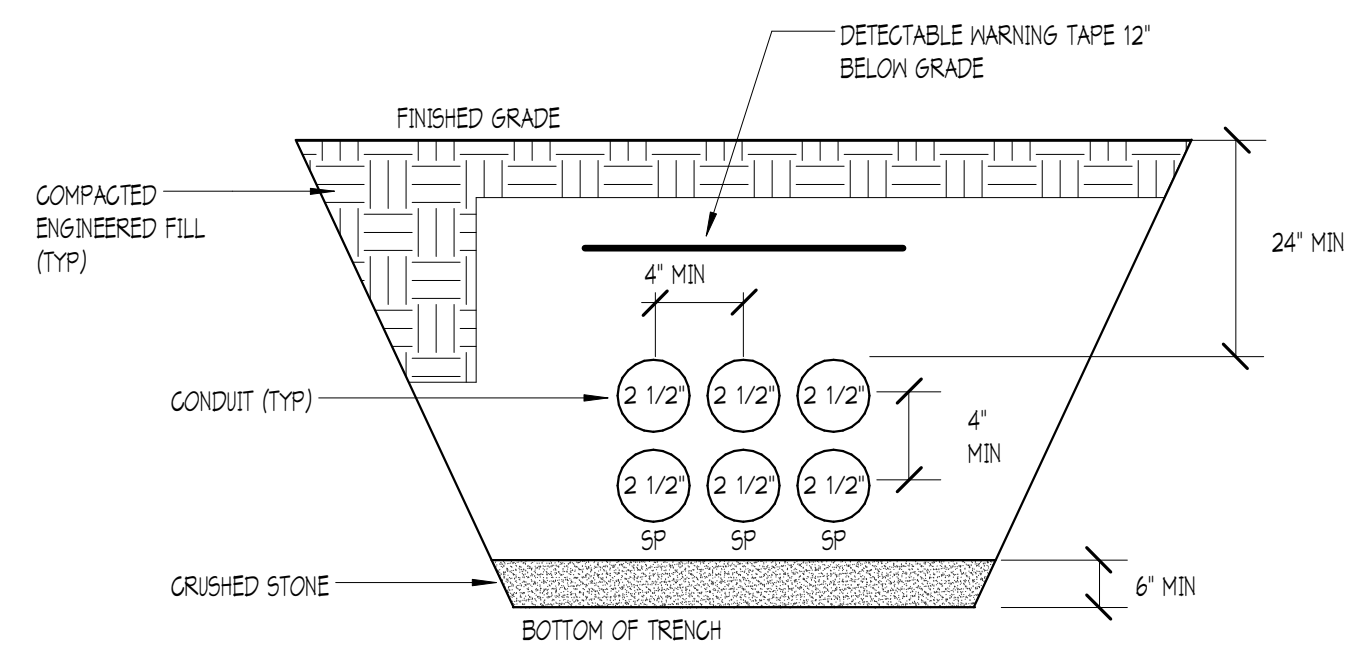
**C1 UTILITY TRANSFORMER PAD DETAIL**  
NOT TO SCALE



**E1 GROUND BUS DETAIL**  
NOT TO SCALE

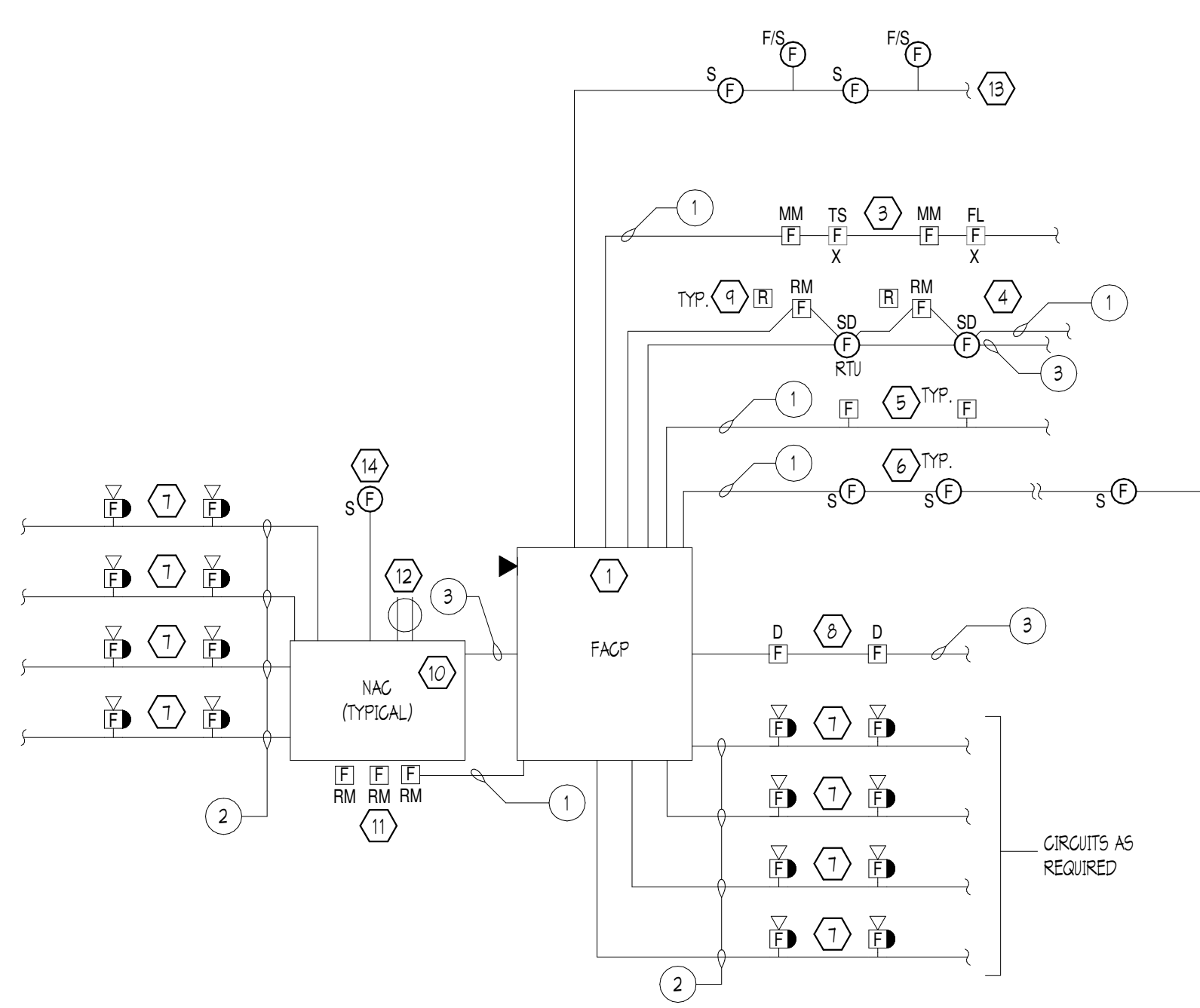


**G1 DUCT BANK DETAIL - TRANSFORMER**  
NOT TO SCALE



**G3 DUCT BANK DETAIL - GENERATOR**  
NOT TO SCALE

| SEQUENCE OF OPERATION                  |  | INPUT CONDITION |                       |              |                  |                     |                         |                                     |   |   |  |  |
|--|--|-----------------|-----------------------|--------------|------------------|---------------------|-------------------------|-------------------------------------|---|---|--|--|
| SYSTEM REACTION                        |  | SPRINKLER FLOW  | SMOKE / HEAT DETECTOR | PULL STATION | SPRINKLER TAMPER | DUCT SMOKE DETECTOR | 120V POWER LOSS AT FACP | DEVICE REMOVAL AND PANEL OPEN, ETC. |   |   |  |  |
| ALARM AT FACP                          |  | X               | X                     | X            |                  |                     |                         |                                     |   |   |  |  |
| SUPERVISORY AT FACP                    |  |                 |                       |              | X                | X                   |                         |                                     |   |   |  |  |
| TROUBLE AT FACP                        |  |                 |                       |              |                  |                     | X                       | X                                   |   |   |  |  |
| NOTIFY SCOTT COUNTY CENTRAL MONITORING |  | X               | X                     | X            | X                | X                   | X                       | X                                   | X | X |  |  |
| ACTIVATE BUILDING WIDE NOTIFICATION    |  | X               | X                     | X            |                  |                     |                         |                                     |   |   |  |  |
| DROP DOOR HOLDERS                      |  | X               | X                     | X            |                  |                     |                         |                                     |   |   |  |  |
| SHUT DOWN ASSOCIATED AHU               |  |                 |                       |              |                  |                     | X                       |                                     |   |   |  |  |

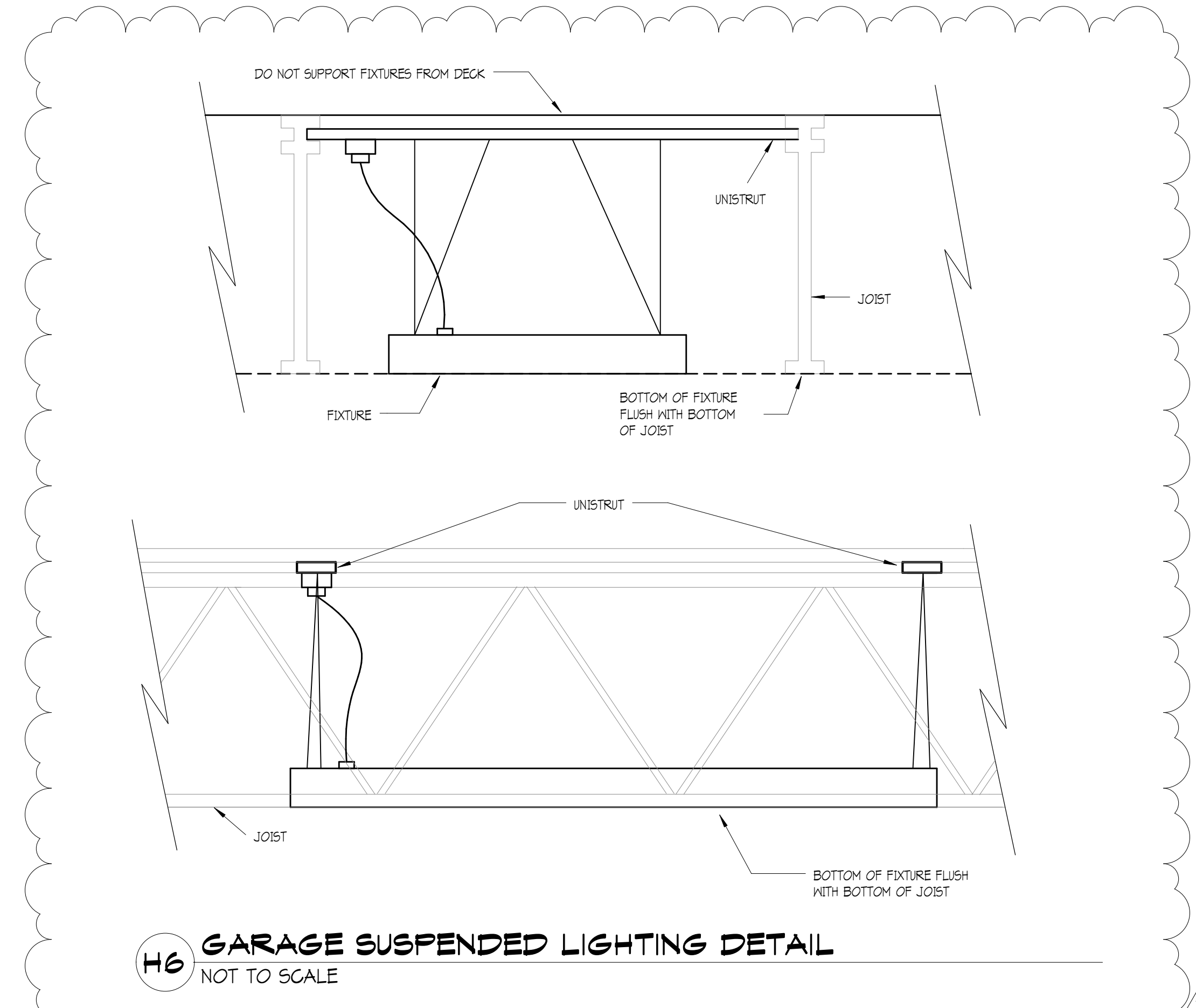


**E5 FIRE ALARM RISER DIAGRAM**  
NOT TO SCALE

| WIRING / CABLING SCHEDULE |                 |  |
|---------------------------|-----------------|--|
| CABLE / WIRE              | CABLE FUNCTION  | CABLE / WIRE DESCRIPTION               |
| 1                         | DATA (ELC) LOOP | 16/2 AWG FPLP (RED) TWISTED NON-SHIELD |
| 2                         | HORN / STROBE   | 14 AWG FPLP (RED) OR THIN              |
| 3                         | 24VDC POWER     | 14 AWG FPLP (RED) OR THIN              |
| 4                         | ANNUNCIATOR     | (2) DATA LOOPS + (1) 24VDC POWER       |

- FIRE ALARM GENERAL NOTES**
- DEVICES AND CABLING SHOWN ARE SCHEMATIC. CONTRACTOR SHALL VERIFY QUANTITIES AND CONTROL REQUIREMENTS AND PROVIDE.
  - NAC CIRCUITS / PANELS / LABELS SHOWN ARE SCHEMATIC. CONTRACTOR SHALL PROVIDE LAYOUT BASED ON VOLTAGE DROP, DEVICE LAYOUTS, AND AMPACITY REQUIREMENTS.
  - IN ADDITION TO THE DEVICES AND APPLIANCES SHOWN ON DRAWINGS, THE FOLLOWING DEVICES SHALL BE PROVIDED WHERE DIRECTED BY ENGINEER DURING CONSTRUCTION. INSTALLATION OF DEVICES SHALL INCLUDE 50' OF WIRING AND ASSOCIATED RACKWAY AS REQUIRED.
- HORN / STROBE: PROVIDE (6) TO BE LOCATED AND INSTALLED IN THE FIELD. PROVIDE A CREDIT OF \$250 FOR EACH DEVICE NOT INSTALLED.
  - VISUAL ONLY NOTIFICATION DEVICE: PROVIDE (6) TO BE LOCATED AND INSTALLED IN THE FIELD. PROVIDE A CREDIT OF \$250 FOR EACH DEVICE NOT INSTALLED.
  - DUCT / SMOKE DETECTOR: PROVIDE (6) TO BE LOCATED AND INSTALLED IN THE FIELD. PROVIDE A CREDIT OF \$150 FOR EACH DEVICE NOT INSTALLED.

- FIRE ALARM KEYED NOTES**
- PROVIDE NOTIFIER FIRE ALARM CONTROL PANEL. ALL NEW DEVICES TO CONNECT TO PANEL.
  - NOT USED.
  - PROVIDE SPRINKLER TAMPER AND FLOW SWITCHES AS INDICATED ON PLANS. COORDINATE WITH MECHANICAL.
  - PROVIDE DUCT SMOKE DETECTOR. PROVIDE KEYED TEST SWITCHES FOR DUCT SMOKE DETECTORS ABOVE 10' AFF AND AS REQUIRED. CONNECT AS A SUPERVISORY SIGNAL AND NOT GENERAL EVALUATION.
  - PROVIDE MANUAL PULL STATION. PROVIDE GUARD, AS INDICATED ON PLANS.
  - PROVIDE SMOKE DETECTOR AS INDICATED ON PLANS.
  - PROVIDE CEILING OR WALL MOUNTED HORN/STROBE DEVICE. VERIFY FIELD SELECTABLE GANGLA / AND WATTAGE TAP RATINGS. (CIRCUIT DESIGNATIONS ARE SCHEMATIC, VERIFY QUANTITY AND AREA OF CONTROL.)
  - PROVIDE DOOR HOLDERS AS INDICATED ON PLANS. VERIFY DOOR HOLDER QUANTITIES. PROVIDE ADDITIONAL POWER SUPPLIES AS REQUIRED.
  - PROVIDE RELAY MODULES FOR AIR HANDLER SHUT DOWN. ADDITIONALLY, PROVIDE 'RSB' INTERPOSING RELAY.
  - PROVIDE SWAMP NOTIFICATION APPLIANCE CIRCUIT (NAC) PANELS. EACH NAC PANEL SHALL HAVE ON-BOARD SYNCHRONIZATION MODULES AND BE CAPABLE OF CONTROLLING / SILENCING HORNS SEPARATELY FROM STROBES. TYPICAL OF ALL NAC PANELS. LOCATE PANELS IN TELECOMMUNICATIONS GLOUBETS WHERE POSSIBLE. OWNER/ENGINEER SHALL PRIOR APPROVE LOCATION PRIOR TO ROUGH-IN.
  - PROVIDE RELAY MODULES FOR ACTIVATION OF HORN AND STROBE CIRCUITS AND PROVIDE MONITOR MODULE FOR MONITORING OF TROUBLES FROM NAC PANEL. TYPICAL FOR EACH NAC PANEL.
  - PROVIDE 120V, 20A DEDICATED CIRCUIT FOR EACH NAC PANEL FROM PANEL ENDS. PROVIDE 20A/1P BREAKER.
  - PROVIDE SMOKE DETECTORS FOR F/S DAMPERS AS INDICATED ON PLANS. VERIFY ALL LOCATIONS IN FIELD (TYPICAL).
  - PROVIDE SMOKE DETECTORS OVER NAC PANEL LOCATIONS.



**H6 GARAGE SUSPENDED LIGHTING DETAIL**  
NOT TO SCALE

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I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed PROFESSIONAL ENGINEER under the laws of the State of IOWA  
*Bradley R. Johannsen*  
BRADLEY R. JOHANNSEN  
Registration Number 18475 Date 2/8/16

| Description | Revisions | Date   | Rev |
|-------------|-----------|--------|-----|
| ADDENDUM #4 |           | 3/2/16 | 1   |
|             |           |        |     |
|             |           |        |     |

Comm: 133030  
Date: 2/8/16  
Drawn: A. NELSON  
Check: B. JOHANNSEN

**ELECTRICAL DETAILS**

Scale: As indicated

**E8.1**