

**THE SCHOOL DISTRICT OF PHILADLPHIA  
SCHOOL REFORM COMMISSION  
Office of Capital Programs  
440 North Broad Street, 3<sup>rd</sup> Floor – Suite 371  
Philadelphia, PA 19130**

TELEPHONE: (215) 400-4730

**Addendum No. 02**

**Subject:** Camelot Academy – Generator Replacement  
SDP Contract No. B-036C of 2018/19

**Location:** Camelot Academy  
1435 N. 26<sup>th</sup> Street  
Philadelphia, Pennsylvania 19121

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**This Addendum, dated August 21, 2019, shall modify and become part of the Contract Documents for the work of this project. Any items not mentioned herein, or affected by, shall be performed strictly in accordance with the original documents.**

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**This addendum incorporates the revisions to the Bidding and Contract Documents required by the relocation of the New Emergency Generator from inside the building to an outside location.**

**1. Pre-bid Meeting and Site visit has been scheduled at the project site on Tuesday, September 10, 2019 at 10:00AM**

**2. Bid Opening will take place at Capital Programs, Suite 371, 3<sup>rd</sup> Floor, 440 North Broad on Tuesday, September 24, 2019 at 2:00 PM**

**3. DELETE 01 1000 1.4 SUMMARY OF WORK DESCRIPTION and INSERT the following:**

Summary Scope of Work: The Work includes, but is not limited to:

- Remove the existing 15 kW natural gas generator, including all battery connections, battery chargers, batteries, exhaust piping, gas connections, and disconnect switches, feeders and conduit.
- Remove exterior exhaust and all piping from generator to outside.
- Remove existing natural gas line from generator to source. Cap and seal natural gas branch piping at natural gas meter.
- Remove existing automatic transfer switch (ATS). Remove existing feeders from ATS to generator and panel board.
- Clean existing housekeeping pad and extend as required to match new generator footprint.
- Replace the existing generator with a new outdoor 120/240V, 1-phase, 15 kW diesel generator set and integral belly tank. The generator shall include new battery charger, batteries, and feeders and RMC conduit to new ATS.
- Provide a fence enclosure and bollards for the generator.
- Provide a new generator remote annunciator in Building Engineer's Office.
- Replace existing ATS with a new 100A, 2 pole ATS. Provide new feeders connecting from ATS to new emergency panel and generator. Reconnect existing normal power feeders.
- Provide new exterior wall penetrations for conduits.

- Replace the existing emergency panel with a 100A, 42 pole, single phase and 120/240V panel.

**4. Attached are Updated Complete Specifications**

**5. Attached are Updated Complete Drawings:**

**End of Addendum No. 02.**

SECTION 030300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide cast-in-place concrete, as hereinafter specified and/or as otherwise required for the proper and timely completion of this Contract. Requirements (materials, mixes, finishes) apply to concrete work specified in other sections, such as sidewalk paving.

1.2 RULES AND REGULATIONS

- A. Standards:
1. ACI 301, Specifications for Structural Concrete for Buildings.
  2. ACI 318, Building Code Requirements for Reinforced Concrete, and CRSI Manual of Standard Practice.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Design Mixes, ASTM C 94, 28 Day Compressive Strength:
1. Columns, Beams, Walls, Foundations, and Footings:
    - a. Compressive Strength: 3000 psi.
  2. Slabs on Grade and Paving Base:
    - a. Compressive Strength: 3000 psi.
  3. Concrete on Metal Deck:
    - a. Compressive Strength: 3000 psi.
  4. Exterior Site Concrete and Pads Exposed to Weather:
    - a. Compressive Strength: 3000 psi.
- B. Formwork: Plywood or metal panel formwork sufficient for structural and visual requirements.
1. Special forms for textured finish concrete.
  2. Metal, plastic or paper tubes for cylindrical columns and supports.
- C. Reinforcing Materials:
1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
  2. Reinforcing Bars: ASTM A 767, Class II, galvanized.
  3. Reinforcing Bars: ASTM A 775, epoxy-coated.
  4. Steel Wire: ASTM A 82.
  5. Steel Wire Fabric: ASTM A 185, welded.
  6. Steel Wire Fabric: ASTM A 497, welded, deformed.
  7. Fiber Reinforcement: Engineered polypropylene fibers for secondary reinforcement of slabs.
- D. Concrete Materials: ASTM C 150, Type I, Portland cement; potable water.
1. Normal weight aggregates, ASTM C 33.
  2. Lightweight aggregates, ASTM C 330.
  3. Fly Ash: ASTM C 618, Type F.
  4. Fiber Reinforcement: Polypropylene fibers for secondary reinforcement, ASTM C 1116, Type III.
- E. Concrete Admixtures: Containing less than 0.1 percent chloride ions.

1. Air-Entraining Admixture: ASTM C 260, for exterior exposed concrete and foundations exposed to freeze-thaw.
  2. Water-Reducing Admixture: ASTM C 494, Type A, for placement and workability.
  3. High-Range Water-Reducing Admixture, Super Plasticizer: ASTM C 494, Type F or G for placement and workability.
  4. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E for placement and workability.
  5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D for placement and workability.
- F. Auxiliary Materials:
1. Reglets: Galvanized sheet steel reglets, minimum 26 gauge (.018 inch).
  2. Waterstops: Rubber or PVC waterstops.
  3. Vapor Retarder: ASTM E 154-polyethylene sheet, 8 mils.
  4. Vapor Barrier: Premolded membrane, ASTM E 96, Method B, 0 vapor transmission rate.
  5. Nonslip Aggregate Finish: Fused aluminum oxide granules or crushed emery.
  6. Liquid Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class A.
  7. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type 1, Class B.
  8. Evaporation Control Compound: Monomolecular film-forming compound.
  9. Underlayment Compound: Free-flowing, self-leveling cement-based compound.
  10. Bonding Compound: Polyvinyl acetate or acrylic base.
  11. Epoxy Adhesive: ASTM C 881, two-component material.
- G. Concrete Finishes For Formed Surfaces:
1. Surfaces Not Exposed To View: As-cast form finish.
  2. Surfaces Exposed To View: Smooth form finish.
  3. Surfaces Exposed To View: Smooth rubbed finish.
  4. Surfaces Exposed To View: Grout-cleaned finish.
  5. Surfaces Exposed To View: Special textured form finish.
- H. Concrete Finishes for Monolithic Slabs:
1. Scratch finish for surfaces to receive concrete floor topping or mortar setting bed.
  2. Trowel finish for surfaces to be exposed to view or covered with resilient flooring, carpet, tile, or other thin finish system.
  3. Trowel and fine broom finish for surfaces to receive thin-set ceramic or quarry tile.
  4. Nonslip broom finish for exterior concrete platforms, steps, ramps, and sloped walls.
  5. Nonslip aggregate finish for concrete stair treads, platforms, ramps, and sloped walks.
  6. Exposed aggregate finish, chemical retarder type.
  7. Patterned finish, pressed into concrete.
  8. Colored wear-resistant finish, dry shake type.

END OF SECTION 03300

## SECTION 078400 – FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SECTION INCLUDES

- A. Firestopping systems.

#### 1.3 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops;2013a.
- B. UL Standard 1479 - Standard for Fire Tests of Penetration Firestops

#### 1.4 SUBMITTALS

- A. Action Submittals:
  - 1. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- B. Informational Submittals:
  - 1. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
  - 2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### 1.5 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.1.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.6 SITE CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### PART 2 - PRODUCTS

#### 2.1 FIRESTOPPING - GENERAL REQUIREMENTS

- A. Manufacturers:
  - 1. A/D Fire Protection Systems Inc.: [www.adfire.com](http://www.adfire.com).
  - 2. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).

3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
4. Nelson FireStop Products: [www.nelsonfirestop.com](http://www.nelsonfirestop.com).
5. Or approved equal.

- B. Materials: Use any material meeting requirements.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
- D. Fire Ratings: See Drawings for specifically required systems and ratings.

## 2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
  2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
  3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

### 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### 3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Install labeling required by code.

### 3.4 FIELD QUALITY CONTROL

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

### 3.5 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 260000 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.



- D. Coordinate sleeve selection and application with selection and application of firestopping specified in General and Supplementary Conditions."

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in General and Supplementary Conditions.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in General and Supplementary Conditions.

- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in General and Supplementary Conditions.

END OF SECTION 260000

## SECTION 260519 - CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Senator Wire & Cable Company.
  - 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in General and Supplementary Conditions.

2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.

2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Carbon steel. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

#### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- D. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

#### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical System."
- F. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in General and Supplementary Conditions.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to General and Supplementary Conditions.

- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to General and Supplementary Conditions.
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to General and Supplementary Conditions.

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test branch circuit, and conductors feeding the following critical equipment and services for compliance with requirements.
    - a. Fire alarm system.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.



- b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
- 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, **provide products by the following:**
  1. [Burndy; Part of Hubbell Electrical Systems.](#)
  2. [Dossert; AFL Telecommunications LLC.](#)
  3. [ERICO International Corporation.](#)
  4. [Fushi Copperweld Inc.](#)
  5. [Galvan Industries, Inc.; Electrical Products Division, LLC.](#)
  6. [Harger Lightning and Grounding.](#)
  7. [ILSCO.](#)
  8. [O-Z/Gedney; A Brand of the EGS Electrical Group.](#)
  9. [Robbins Lightning, Inc.](#)
  10. [Siemens Power Transmission & Distribution, Inc.](#)

## 2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  - 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
  - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.



## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in General and Supplementary Conditions.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or

greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in General and Supplementary Conditions.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

## SECTION 260533 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
  2. Alflec Inc.
  3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  5. Electri-Flex Co.
  6. Manhattan/CDT/Cole-Flex.
  7. Maverick Tube Corporation.
  8. O-Z Gedney; a unit of General Signal.
  9. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  2. Fittings for EMT: Steel, compression type.
  3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

### 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.
  8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- D. LFNC: UL 1660.
- E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: UL 514B.

### 2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Arnco Corporation.
  2. Endot Industries Inc.
  3. IPEX Inc.
  4. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible type, approved for plenum, riser, and general-use installation.

### 2.4 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Cooper B-Line, Inc.
  2. Hoffman.
  3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

### 2.5 NONMETALLIC WIREWAYS

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

1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Metal Floor Boxes: Cast metal fully adjustable, rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- J. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

## 2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in in General and Supplementary Conditions.

## 2.8 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Advance Products & Systems, Inc.
  2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Carbon steel. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  1. Exposed Conduit: Rigid steel conduit
  2. Concealed Conduit, Aboveground: Rigid steel conduit.
  3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: Rigid steel conduit.
  3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
    - d. Boiler rooms.
    - e. Electrical rooms.
    - f. Fire alarm risers
    - g. Power circuits risers.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: Rigid steel conduit.
  7. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
  8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  2. Electrical Metallic Tubing (EMT) Conduit: Use steel compression type fittings, unless otherwise indicated.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Embedded in Slabs:



1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where otherwise required by NFPA 70.
- M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- O. Set metal floor boxes level and flush with finished floor surface.
- 3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Coordinate sleeve selection and application with selection and application of firestopping specified in General and Supplementary Conditions.

- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to General and Supplementary Conditions for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with General and Supplementary Conditions.
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.4 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in General and Supplementary Conditions.

3.6 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

## SECTION 260553 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Fire Alarm Circuits: White letters on a red field.
  - 3. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

### 2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
  3. Fire Alarm Manual Pull Station Warning: "IN CASE OF FIRE: SOUND ALARM AND CALL THE FIRE DEPARTMENT".

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  1. Engraved legend with black letters on white face.
  2. Punched or drilled for mechanical fasteners.
  3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength: 50 lb, minimum.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in General and Supplementary Conditions.
  1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
    - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

- 1) Primer: Exterior concrete and masonry primer.
  - 2) Finish Coats: Exterior semigloss acrylic enamel.
2. Exterior Concrete Unit Masonry:
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
    - 1) Block Filler: Concrete unit masonry block filler.
    - 2) Finish Coats: Exterior semigloss acrylic enamel.
3. Exterior Ferrous Metal:
  - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Exterior ferrous-metal primer.
    - 2) Finish Coats: Exterior semigloss alkyd enamel.
4. Exterior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Exterior zinc-coated metal primer.
    - 2) Finish Coats: Exterior semigloss alkyd enamel.
5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
  - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior concrete and masonry primer.
    - 2) Finish Coats: Interior semigloss alkyd enamel.
6. Interior Concrete Unit Masonry:
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
    - 1) Block Filler: Concrete unit masonry block filler.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
7. Interior Gypsum Board:
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior gypsum board primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
8. Interior Ferrous Metal:
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior ferrous-metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
9. Interior Zinc-Coated Metal (except Raceways):

- a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
  - 1) Primer: Interior zinc-coated metal primer.
  - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 15 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed fire alarm.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
  - 4. Paint all junction boxes with red color paint and label as "FIRE ALARM".
- F. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
  - 2. Fire Alarm Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for.
- G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power,



lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
  - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
  - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
  - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  
2. Equipment to Be Labeled:
  - a. Panelboards, electrical cabinets, and enclosures.
  - b. Access doors and panels for concealed electrical items.
  - c. Voice and data cable terminal equipment.
  - d. Fire-alarm control panel and annunciators.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded branch-circuit conductors.
  1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made.

Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION 260553

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Lighting and appliance branch-circuit panelboards.

#### 1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 6. Include wiring diagrams for power, signal, and control wiring.
  - 7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.

- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of electric service.
  2. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.
  3. Comply with NFPA 70E.

#### 1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

#### 1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  4. Finishes:
    - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
    - c. Provide baked gray enamel finish over a rust inhibitor inside and outside the cabinets and fronts.

- 5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
  - 1. Material: Tin-plated aluminum.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Tin-plated aluminum.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Penn Panel & Box Company, Willows Avenue, P.O. Box 1458 Collingdale, PA 19023-8458, Telephone: (610)586-2700
  - 2. No substitutions.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock.
- F. Locks and keys: All locks and keys for panel boards shall be keyed alike and keyed to the master of the School District of Philadelphia. Locks pull for doors of cabinets shall be Corbin #15767. The master key shall be #CAT60.
- G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
- H. Provide normal-emergency lighting panelboards with 3-way switches for all normal-emergency lighting branch circuits which are to be transferred from normal-emergency power to the emergency only power during non-occupied durations of the building.
- I. The 3-way AC switches shall be general duty, flush type, 30-amperes with mounting yoke insulated from the mechanism. Equip with plaster ears, lock-type switch handles, and side-wired screw terminals with break-off tab features, which allows wiring with separate or common feed.

- J. Flush mount the 3-way on front of the cabinet to operate externally with opening the cabinet. Mount switches horizontally and identify both positions of the switches, emergency position side by red nameplate stating 'EMERGENCY' and black nameplate stating 'NORMAL/EMERGENCY'. Identify each circuit (3-way switch) by a white nameplate. Provide engraving stock melamine plastic nameplates.
- K. Factory wire each 3-way switch to one branch circuit breaker connected to the normal-emergency bus and one branch circuit breaker connected to the emergency only bus of the same phase. All wires shall be copper, S.I.S. type, minimum #10 AWG.
- L. Provide fronts with full hinges and doors (door-in-door construction). Provide fronts with hinges on right unless specified and fasten to the cabinet with machine screws. Provide doors with flush locks and keys with concealed piano door hinges as indicated. Equip door with circuit directory frame and typewritten with card with clear plastic covering.
- M. Each normal-emergency lighting panel board shall be supplied with two power feeders, one normal-emergency power feeder from the automatic transfer switch and one emergency only power feeder from the automatic transfer switch.

### 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

- f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- g. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- G. Comply with NECA 1.

#### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."



- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Weather-resistant receptacles.

#### DEFINITIONS

- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. [Cooper Wiring Devices; Division of Cooper Industries, Inc. \(Cooper\).](#)
2. [Hubbell Incorporated; Wiring Device-Kellems \(Hubbell\).](#)
3. [Leviton Mfg. Company Inc. \(Leviton\).](#)
4. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)

- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  2. Devices shall comply with the requirements in this Section.

## 2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

## 2.4 GFCI RECEPTACLES

- A. General Description:
1. Straight blade, non-feed-through type.
  2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

## 2.5 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.6 FINISHES

### A. Device Color:

1. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

### B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

#### B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

#### C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

#### D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.4 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 262726

## SECTION 263213 - ENGINE GENERATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes packaged engine-generator sets for standby power supply with the following features:
  - 1. Diesel engine.
  - 2. Unit-mounted cooling system.
  - 3. Unit-mounted control and monitoring.
  - 4. Outdoor enclosure.
- B. Related Sections include the following:
  - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

#### 1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
  - 1. Thermal damage curve for generator.
  - 2. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
  - 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.



3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
  1. Certified summary of prototype-unit test report.
  2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
  3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
  4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
  5. Report of sound generation.
  6. Report of exhaust emissions showing compliance with applicable regulations.
  7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
  2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
  1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
  2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and

engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with ASME B15.1.
- G. Comply with NFPA 37.
- H. Comply with NFPA 70.
- I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- J. Comply with UL 2200.
- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- L. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

#### 1.9 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager and Owner no fewer than 14 days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet.

#### 1.10 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: 5 years from date of Substantial Completion.

#### 1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. [Caterpillar; Engine Div.](#)
  2. [Kohler Co.; Generator Division.](#)
  3. [Onan/Cummins Power Generation; Industrial Business Group.](#)
  4. MTU Onsite Energy, A Rolls-Royce Power System Brand

#### 2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
  1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated.
2. Output Connections: One-phase, three wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. Governor: Mechanical.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 25 dB at 500 Hz.
  2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.
- J. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 12-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
  2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: As required by NFPA 110 for system level specified.
  4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
  5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
  7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

- a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

## 2.4 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
  1. Tank level indicator.
  2. Capacity: Fuel for 48 number hours' continuous operation at 100 percent rated power output.
  3. Vandal-resistant fill cap.
  4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

## 2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
  1. AC voltmeter.
  2. AC ammeter.
  3. AC frequency meter.
  4. DC voltmeter (alternator battery charging).
  5. Engine-coolant temperature gage.

6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- E. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
  2. Coolant low-temperature alarm.
  3. Control switch not in auto position.
  4. Battery-charger malfunction alarm.
  5. Battery low-voltage alarm.
- F. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- G. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

## 2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
1. Tripping Characteristic: Designed specifically for generator protection.
  2. Trip Rating: Matched to generator rating.
  3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

## 2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.

- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

## 2.8 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, Level 1 sound attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

## 2.9 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
  - 1. Material: Standard neoprene.
  - 2. Durometer Rating: 30.
  - 3. Number of Layers: Two.

## 2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

## 2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.



1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  2. Full load run.
  3. Maximum power.
  4. Voltage regulation.
  5. Transient and steady-state governing.
  6. Single-step load pickup.
  7. Safety shutdown.
  8. Report factory test results within 10 days of completion of test.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
  1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 IDENTIFICATION

- A. Identify system components according to Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
  - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    - c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  6. Exhaust Emissions Test: Comply with applicable government test criteria.
  7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
  2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

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

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes transfer switches rated 600 V and less, including the following:
  - 1. Automatic transfer switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Features and operating sequences, both automatic and manual.
  - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA ICS 1.

- E. Comply with NFPA 70.
- F. Comply with NFPA 110.
- G. Comply with UL 1008 unless requirements of these Specifications are stricter.

#### 1.6 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
  - 1. Notify Construction Manager and Owner no fewer than 14 days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

#### 1.7 COORDINATION

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURED UNITS

- A. Contactor Transfer Switches:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. [Caterpillar; Engine Div.](#)
    - b. [Emerson; ASCO Power Technologies, LP.](#)
    - c. [Kohler Power Systems; Generator Division.](#)
    - d. [Onan/Cummins Power Generation; Industrial Business Group.](#)
    - e. MTU Onsite Energy, A Rolls-Royce Power Systems Brand.

#### 2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switch Action: Double throw; mechanically held in both directions.
  - 2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
- F. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
  - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
  - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
  - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
  - b. Push-button programming control with digital display of settings.
  - c. Integral battery operation of time switch when normal control power is not available.

## 2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Identify components according to Section 260553 "Identification for Electrical Systems."
- B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

### 3.2 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    - a. Check for electrical continuity of circuits and for short circuits.
    - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    - c. Verify that manual transfer warnings are properly placed.
    - d. Perform manual transfer operation.
  - 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.
    - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    - e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
  - 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

- a. Verify grounding connections and locations and ratings of sensors.
- B. Coordinate tests with tests of generator and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.
- F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

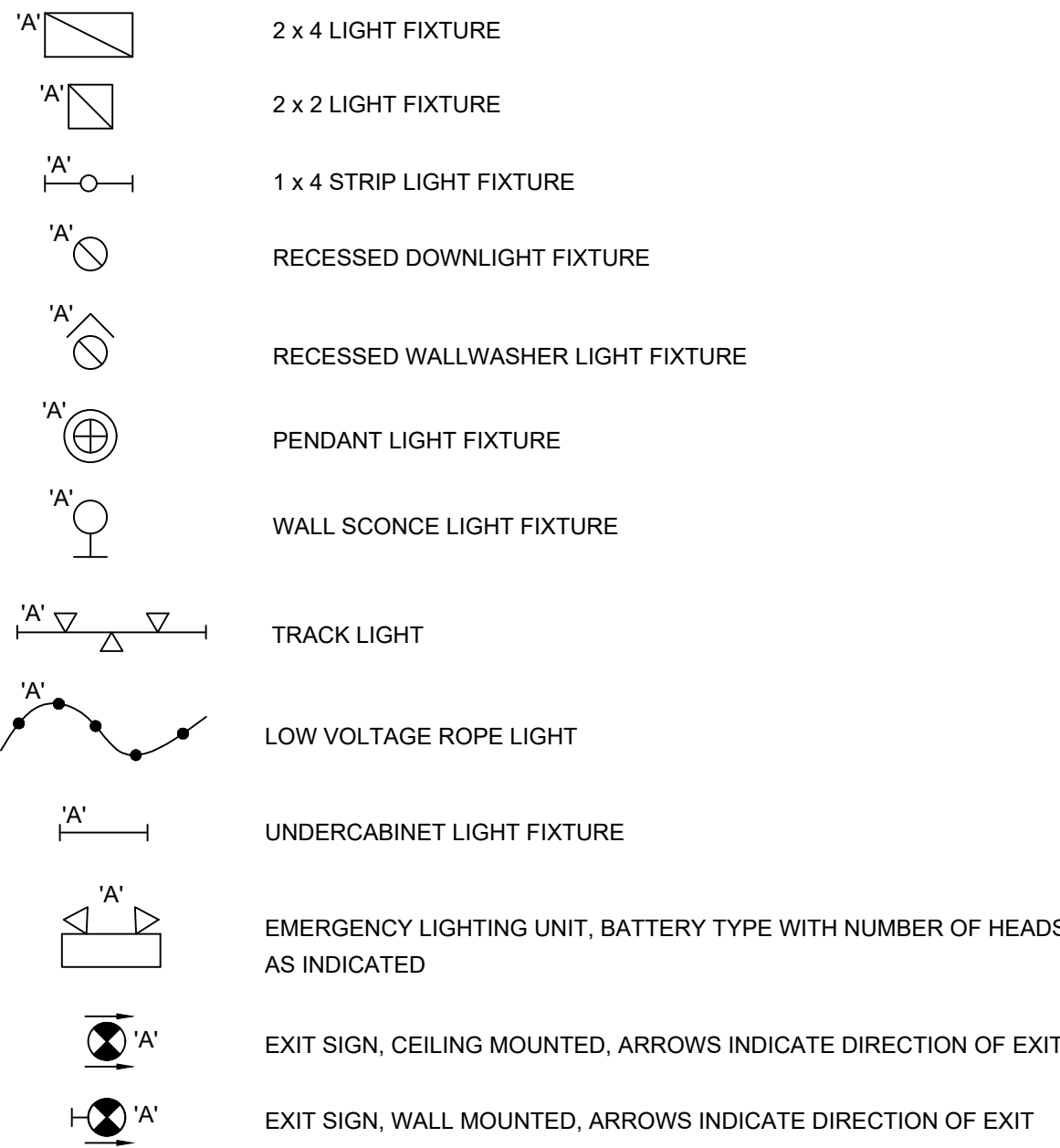
#### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
- B. Coordinate this training with that for generator equipment.

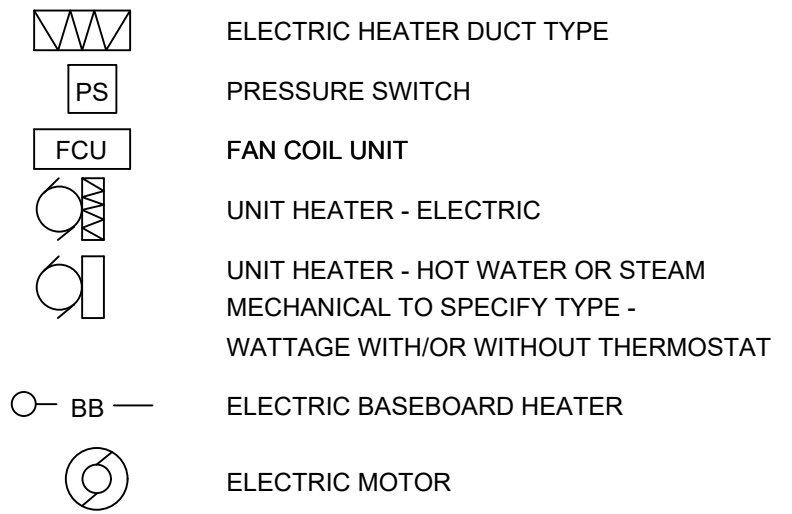
END OF SECTION 263600

LIGHTING

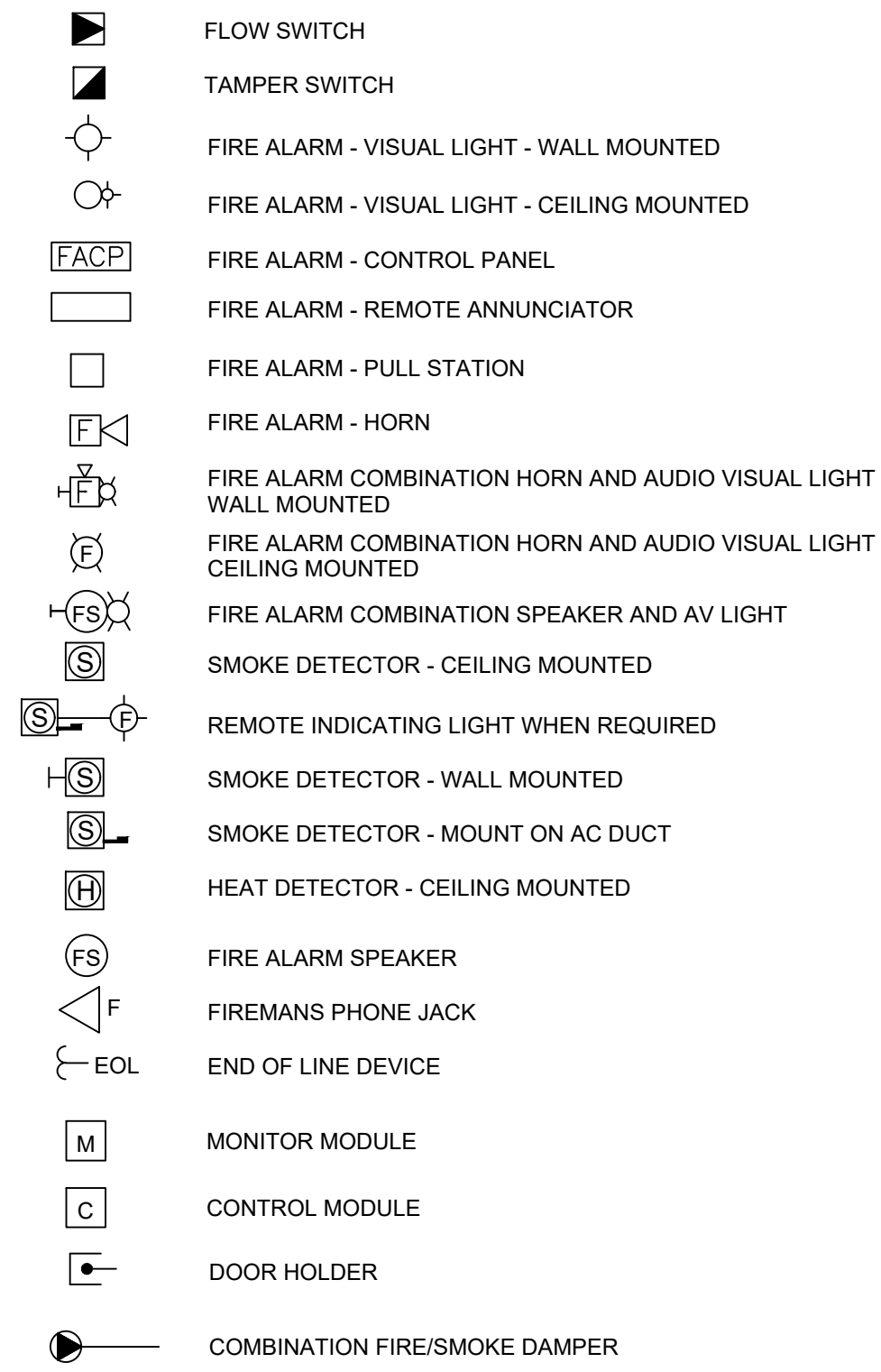
LIGHTING (NOTE: UPPER CASE LETTER INDICATES FIXTURE TYPE)



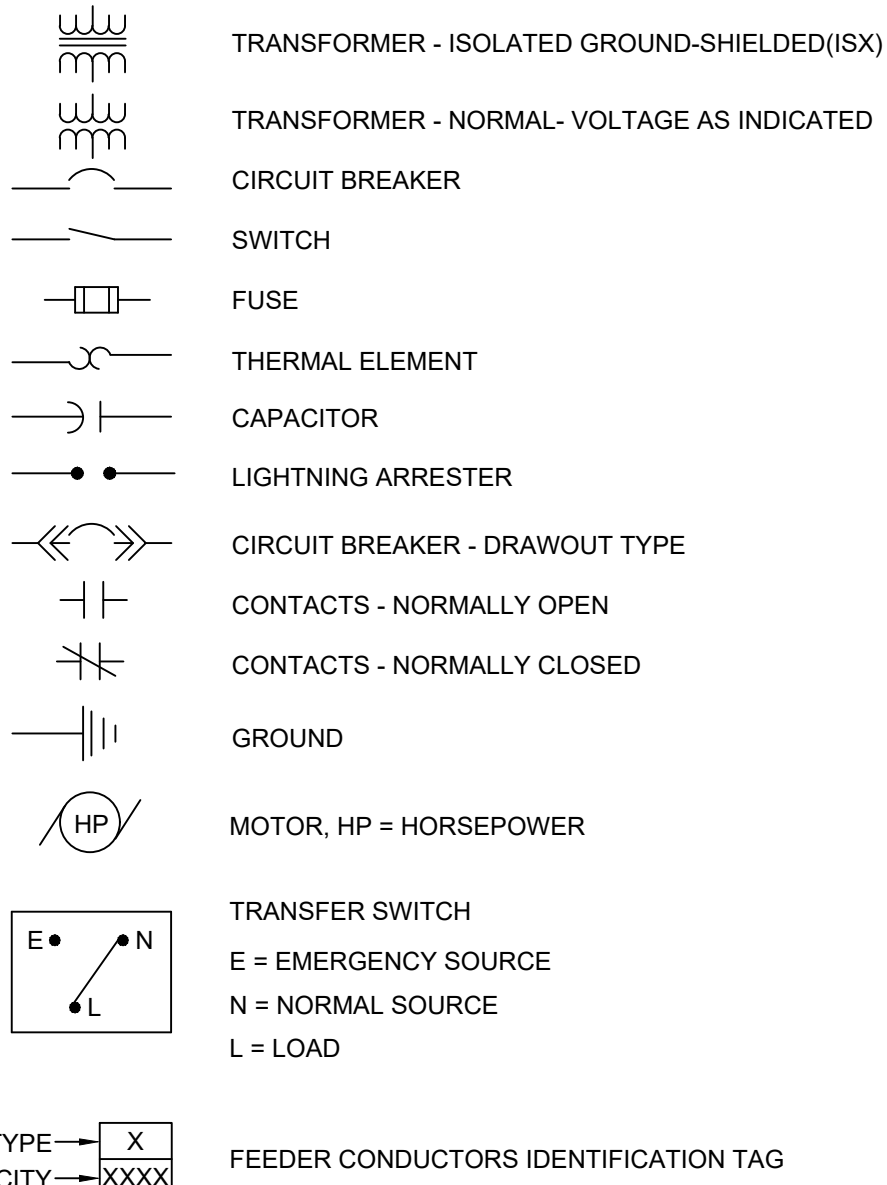
MECHANICAL/ELECTRICAL



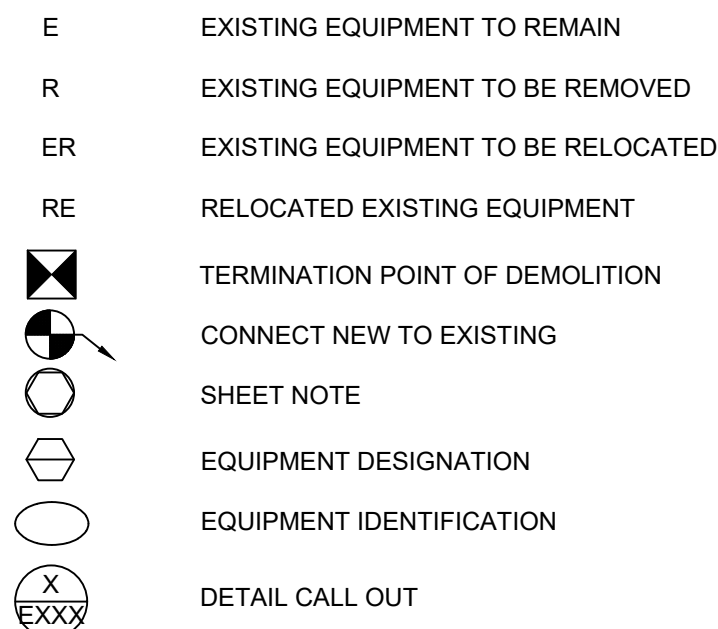
FIRE ALARM



SINGLE LINE SYMBOLS



GENERAL



MOUNTING HEIGHTS

- ALL MOUNTING HEIGHTS LIST ARE TO CENTER OF DEVICE UNLESS OTHERWISE NOTED AND MUST CONFORM TO ADA, NFPA, ANSI 117.1 REQUIREMENTS UNLESS OTHERWISE NOTED.
- CONTRACTOR TO VERIFY FINAL LOCATION OF ALL DEVICES WITH ARCHITECT AND/OR INTERIOR DESIGNER.
- WHERE DEVICES FALL ON TWO SURFACE FINISHES, RAISE THE DEVICE TO BE ON A SINGLE FINISH. COORDINATE WITH ARCHITECT.

FIRE ALARM GONG AND BELL (WALL MOUNTED)	6'-8" MAX. HT. OR 6" BELOW CLG. WHICHEVER IS LOWER
FIRE ALARM STROBE LIGHT & SIGNALING DEVICES (WALL MOUNTED)	ENTIRE LENS IS NOT LESS THAN 80" AND NOT GREATER 96" AFF. WHERE LOW CEILINGS DO NOT PERMIT MOUNTING AT MIN. 80" DEVICE SHALL BE MOUNTED WITHIN 6" OF THE CEILING.
TOP OF LIGHTING AND/OR POWER PANELS IN COMMON BUILDING SPACES TOP OF TELEPHONE CABINET (MAXIMUM)	6' - 2" AFF
TOP OF LIGHTING AND/OR POWER PANELS IN LIVING UNITS	4' - 6" AFF TO HIGHEST OPERABLE DEVICE
TOP OF BACK MOUNTED EXIT FIXTURE (NOT LOCATED ABOVE DOORS)	12" BELOW FINISHED CEILING TO CENTERLINE
TOP OF SAFETY DISCONNECT SWITCH, CONTACTORS, MAGNETIC MOTOR STARTERS	6' - 0" MAXIMUM AFF
**	6" BELOW FINISHED CEILING
**	4' - 0" AFF OR 6" ABOVE COUNTER
*	BELOW COUNTER
TELEPHONE (TOP OF COIN SLOT) TELEPHONE OUTLET (WALL), LIGHT SWITCHES	3' - 6" AFF
MANUAL CONTROL DEVICES, FIRE ALARM PULL STATION, FIRE PHONE JACKS	3' - 6" AFF
RECEPTACLES, TELEPHONE OUTLETS (DESK) TELEVISION OUTLETS COMPUTER OUTLETS	1' - 6" (MIN.) AFF
FINISHED FLOOR ELEV. (BASE)	0' - 0"

LEGEND NOTES

THIS SHEET IS A GENERAL LIST OF SYMBOLS AND ABBREVIATIONS AND SHALL BE USED AS A DICTIONARY TO DEFINE ITEMS INDICATED ON DRAWINGS. NOT ALL SYMBOLS OR ABBREVIATIONS ARE NECESSARILY USED ON THIS PROJECT.

BUILDING CODE SUMMARY

APPLICABLE CODES:  
2018 INTERNATIONAL BUILDING CODE  
2018 INTERNATIONAL EXISTING BUILDING CODE  
2017 NATIONAL ELECTRICAL CODE (NFPA 70)  
2005 NFPA 110 - STANDARD FOR EMERGENCY AND STANDBY POWER SYSTEMS

GENERIC ELECTRICAL ABBREVIATIONS

A	AMPERE(S)	LP	LIGHTING PANEL
AC	ALTERNATING CURRENT	LPS	LOW PRESSURE SODIUM
AF	AMP FRAME	MATV	MASTER ANTENNA TELEVISION
AFF	ABOVE FINISHED FLOOR	MC	MECHANICAL CONTRACTOR
AFG	ABOVE FINISHED GRADE	MCC	MOTOR CONTROL CENTER
AL	ALUMINUM	MCM	THOUSAND CIRCLULAR MIL(S)
AT	AMP TRIP	MAGSTR	MAGNETIC STARTER
ATS	AUTOMATIC TRANSFER SWITCH	MH	MANHOLE
AWG	AMERICAN WIRE GAUGE	MIC	MICROPHONE
BOC	BOTTOM OF CONDUIT	MTD	MOUNTED
BFC	BELOW FINISHED CEILING	MTG	MOUNTING
CP	CONDUIT	MTR	MOTOR
CATV	CABLE TELEVISION	MUH	MAKE-UP AIR UNIT
CB	CIRCUIT BREAKER	NC	NORMALLY CLOSED
CC	CONTROL CABINET	NF	NONFUSED
CCTV	CLOSED CIRCUIT TELEVISION	NIC	NOT IN CONTRACT
CKT	CIRCUIT	NL	NIGHT LIGHT
CLG	CEILING	NO	NORMALLY OPEN
CO	CONDUIT ONLY	NTS	NOT TO SCALE
CP	CONTROL PANEL	OL	OVERLOAD ELEMENT
CT	CURRENT TRANSFORMER	PC	PLUMBING CONTRACTOR
CU	COPPER	PE	PHOTO ELECTRIC CELL
DC	DIRECT CURRENT	PF	POWER FACTOR
DE	DUAL ELEMENT	PL	PILOT LIGHT
DP	DOUBLE POLE	PP	POWER PANEL
DS	DISCONNECT SWITCH	PRI	PRIMARY
DT	DOUBLE THROW	PS	PULL SWITCH
EC	ELECTRICAL CONTRACTOR	PTZ	PAN/TILT/ZOOM CAMERA
E	EXHAUST FAN	R	RELAY
E.HTR	ELECTRIC HEATER	RC	REMOTE CONTROL
EM	EMERGENCY LIGHTING	RCP	REFLECTED CEILING PLAN
EMT	ELECTRICAL METALLIC TUBING	RECPT	RECEPTACLE
EOL	END OF LINE RESISTOR	SATV	SATELLITE ANTENNA TELEVISION
EUH	ELECTRIC UNIT HEATER	SEC	SECONDARY
EWC	ELECTRIC WATER COOLER	SP	SINGLE POLE
F	FUSED	SPKR	SPEAKER
FA	FIRE ALARM	ST	SHUNT TRIP
FACP	FIRE ALARM CONTROL PANEL	SW	SWITCH
FDR	FEEDER	SWBD	SWITCHBOARD
FL	FLOOR	T	TELEPHONE
GC	GENERAL CONTRACTOR	TC	TIME CLOCK
GFI	GROUND FAULT INTERRUPT	TD	TIME DELAY
GND	GROUND	TDC	TIME DELAYED CLOSED
HID	HIGH INTENSITY DISCHARGE	TDO	TIME DELAYED OPEN
HP	HORSEPOWER	TV	TELEVISION
HPS	HIGH PRESSURE SODIUM	TYP	TYPICAL
HT	ELECTRIC HEAT TRACE	UFD	UNDERFLOOR DUCT
HW	HEAVYWALL RIGID CONDUIT	UG	UNDER GROUND
HZ	HERTZ(FREQ. IN CYCLES PER SECOND)	UH	UNIT HEATER
I	INTERCOM	UON	UNLESS OTHERWISE NOTED
IG	ISOLATED GROUND	V	VOLTS
IMC	INTERMEDIATE METALLIC CONDUIT	VA	VOLT AMPERE(S)
INC	INCANDESCENT	VAR	VOLT AMPS REACTIVE
JB	JUNCTION BOX	VP	VAPOR PROOF
KCMIL	THOUSAND CIRCLULAR MIL(S)	W	WATTS
KVA	KILOVOLT AMPERE(S)	WP	WEATHERPROOF
KVAR	KILOVAR(S)	XFMR	TRANSFORMER
KW	KILOWATT(S)	XP	EXPLOSION PROOF

DRAWING SCHEDULE

DRAWING NUMBER	DRAWING TITLE
E001.0	COVER SHEET
ED100.0	BASEMENT DEMOLITION PLAN
ED101.0	FIRST FLOOR DEMOLITION PLAN
E101.0	BASEMENT NEW WORK PLAN
E102.0	FIRST FLOOR NEW WORK PLAN
E501.0	DETAILS
E601.0	SCHEDULES AND DIAGRAMS

ADDENDUM #02  
August 15, 2019

NO.	DATE	REVISION
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1	08/15/19	ADDENDUM #02

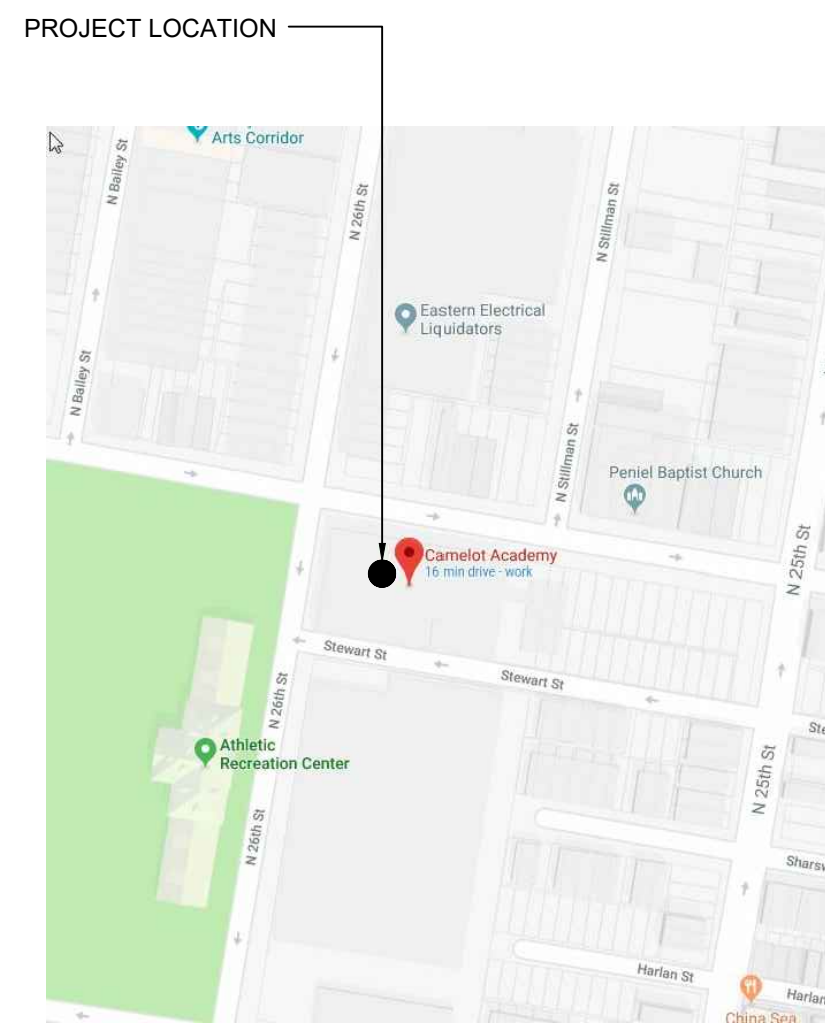
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**CAMELOT ACADEMY**  
1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
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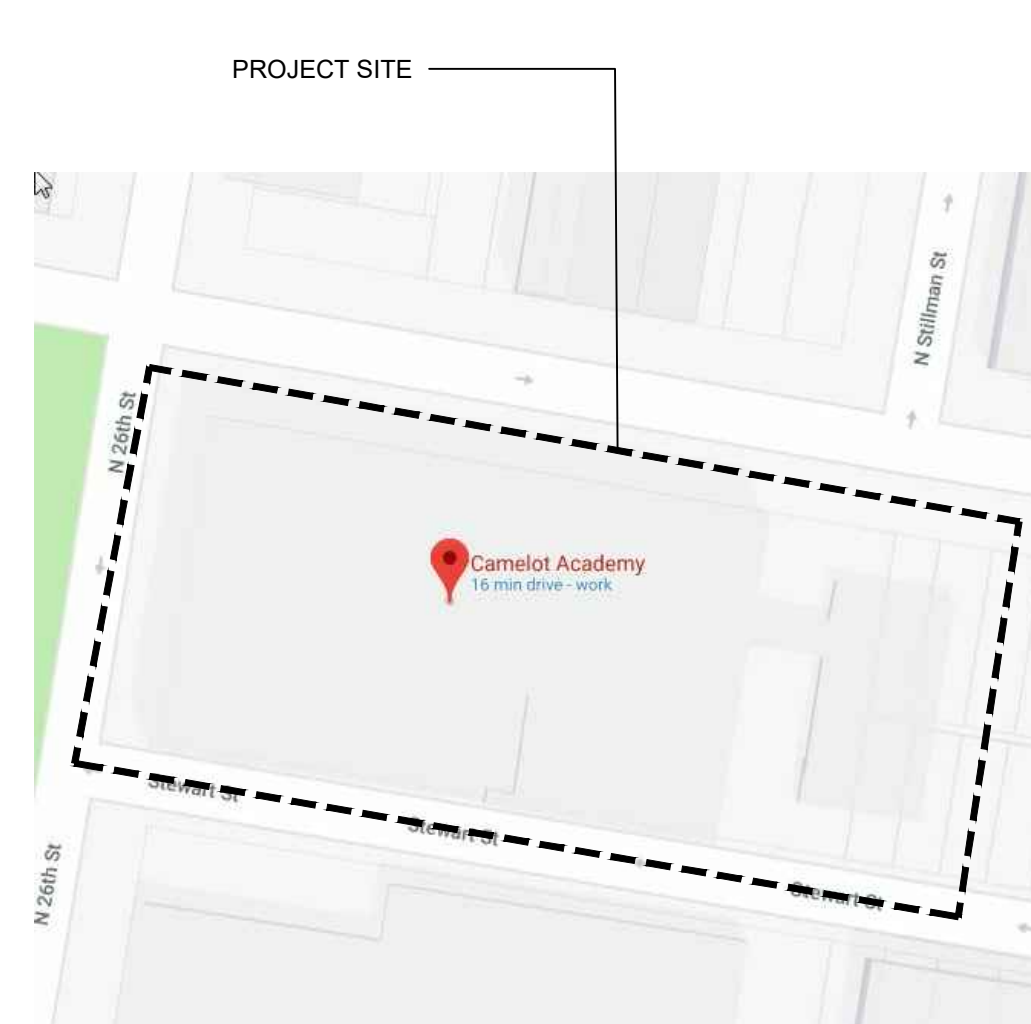
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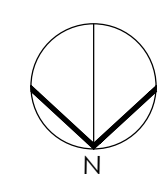
PROJECT VICINITY MAP 1



PROJECT STREET MAP 2



PROJECT SITE PLAN 3



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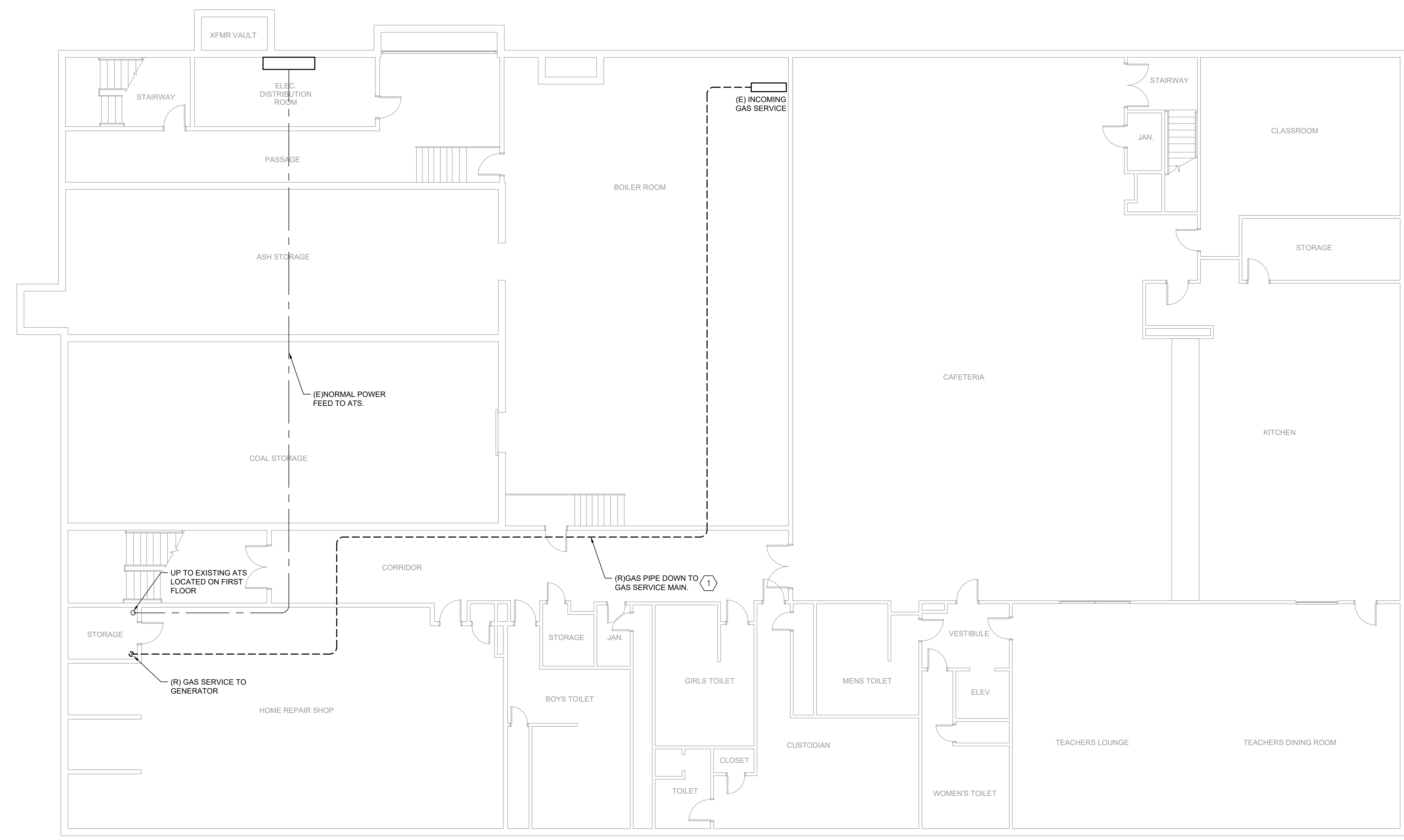
HAYAN V. RIBHAI PATEL, PE  
PENNSYLVANIA LICENSE NO. PE 088847

MEP Engineer

**NORR**

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1817 JFK Boulevard, Suite 1600  
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DEMOLITION KEYNOTES	
1	EXISTING GAS SERVICE FOR GENERATOR TO BE REMOVED BACK TO INCOMING GAS SERVICE. CAP AND SEAL PIPING AT TEE OR CROSS FITTING.



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

**ADDENDUM #02**  
**August 15, 2019**

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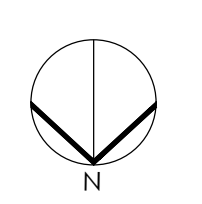
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1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**BASEMENT DEMOLITION PLAN**

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SHEET 2 OF 7



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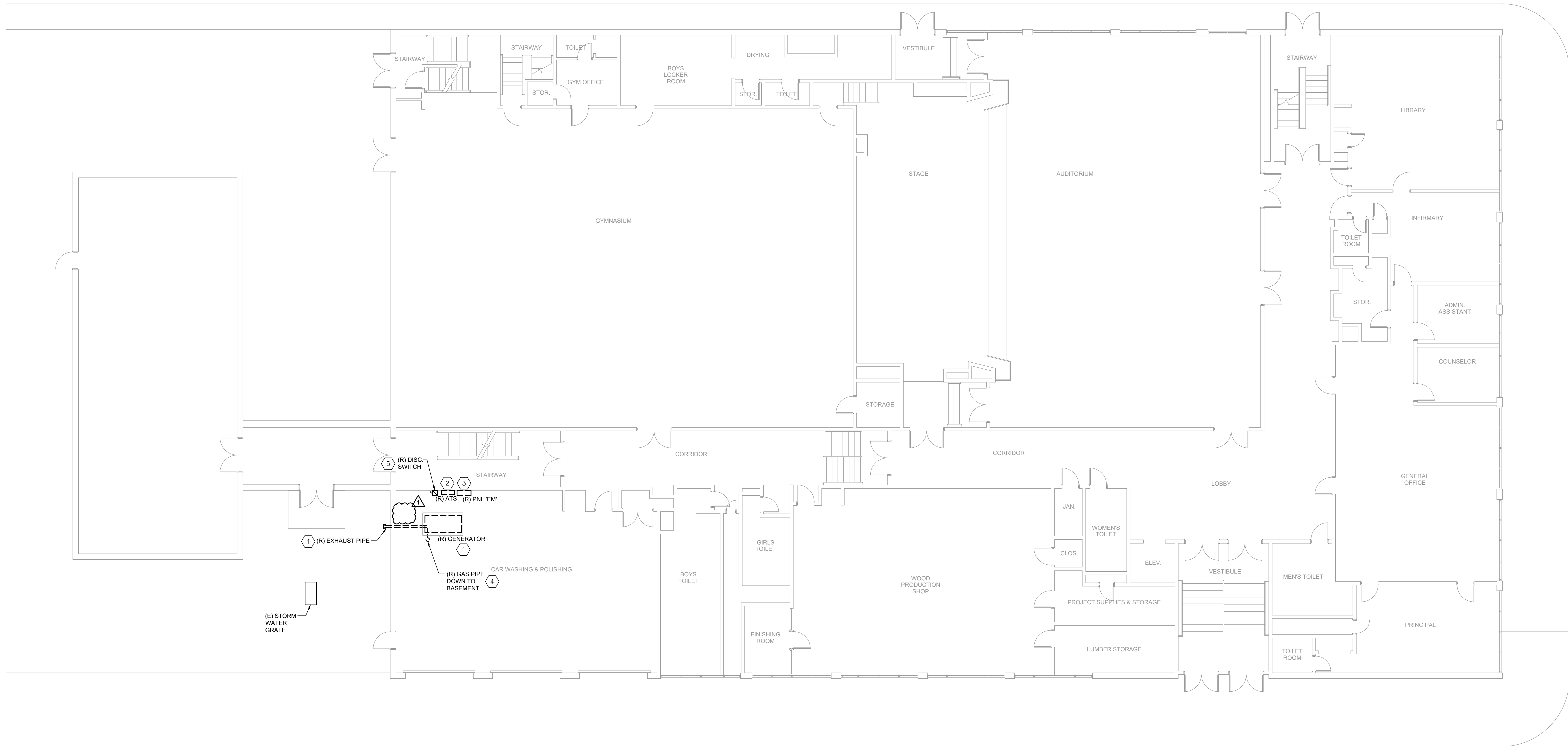
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PENNSYLVANIA LICENSE NO.  
PE 088847

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DEMOLITION KEYNOTES	
1	DISCONNECT AND REMOVE GENERATOR, ALL ASSOCIATED ACCESSORIES (BATTERY CHARGERS, EXHAUST MANIFOLD, ETC.), AND ALL ASSOCIATED WIRING AND CONDUIT. EXISTING CONCRETE HOUSEKEEPING PAD FOR GENERATOR TO REMAIN. CLEAN EXISTING HOUSE-KEEPING PAD AND PREPARE FOR EXTENSION UNDER NEW WORK. DISCONNECT AND REMOVE ALL EXHAUST AND GAS PIPING AND HANGERS. PATCH AND REPAIR WALL PENETRATION FOR EXHAUST PIPING.
2	DISCONNECT AND REMOVE 60A, 2-POLE, 240V AUTOMATIC TRANSFER SWITCH (ATS), DISCONNECT EMERGENCY LINE FEEDERS, LOAD FEEDERS, AND ASSOCIATED CONDUIT. NORMAL POWER FEED FROM MDP TO BE DISCONNECTED AND PREPARED FOR CONNECTION TO NEW AUTOMATIC TRANSFER SWITCH.
3	DISCONNECT AND REMOVE FUSED EMERGENCY PANEL. DISCONNECT AND SAFE OFF ALL (20) BRANCH CIRCUITS, PREPARE FOR RECONNECTION TO NEW PANEL BOARD. REMOVE EXISTING POWER FEEDERS AND CONDUIT BACK TO EXISTING AUTOMATIC TRANSFER SWITCH.
4	EXISTING GAS SERVICE FOR GENERATOR TO BE REMOVED BACK TO MAIN INCOMING GAS SERVICE LOCATION. CAP AND SEAL PIPING AT TEE OR CROSS FITTING. REFER TO DRAWING ED100 FOR CONTINUATION OF EXISTING GAS SERVICE.
5	DISCONNECT AND REMOVE EXISTING 60A, 240V, 3 POLE DISCONNECT SWITCH.



**ADDENDUM #02**  
**August 15, 2019**

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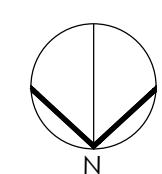
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**CAMELOT ACADEMY**  
1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**FIRST FLOOR DEMOLITION PLAN**

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SHEET **3** OF **7**



SEAL:

HAYAN VRIJIBHAI PATEL, PE  
PENNSYLVANIA LICENSE NO. PE 088847

MEP Engineer

**NORR**

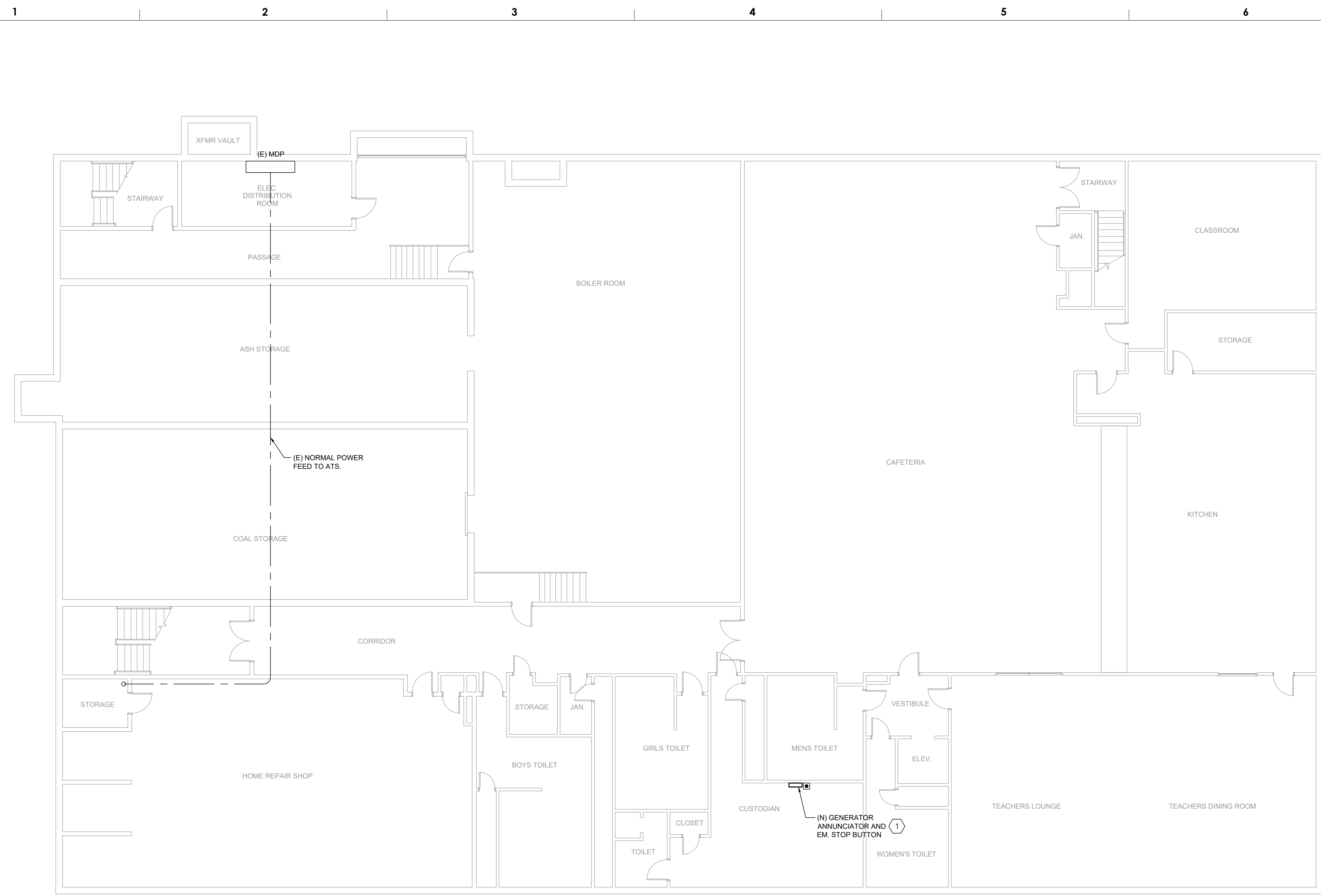
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One Penn Center  
1817 JFK Boulevard, Suite 1600  
Philadelphia, PA 19103 U.S.A.  
norri.com

GENERAL NOTES:

- A. ALL CONDUIT SHALL BE THREADED GALVANIZED RIGID METAL (STEEL) CONDUIT ONLY.
- B. CONTRACTORS SHALL COORDINATE INSTALLATION WITH SDP ENVIRONMENTAL TEAM.

NEW WORK KEY NOTES

- 1. PROVIDE NEW EMERGENCY STOP BUTTON AND GENERATOR ANNUNCIATOR WITH WIRE GUARD CAGE COMPATIBLE WITH NEW GENERATOR. PROVIDE 1" CONDUIT FROM GENERATOR TO EM STOP BUTTON AND ANNUNCIATOR FOR INTERCONNECTION OF BUTTON AND ANNUNCIATOR TO GENERATOR CONTROL PANEL. PROVIDE WIRING INTERCONNECTION PER GENSET MANUFACTURER REQUIREMENTS. ANNUNCIATOR PANEL AND EM STOP BUTTON TO BE LOCATED IN ROOM BUILDING ENGINEERS DESIGNS. ALL EXTERIOR AND INTERIOR WALL PENETRATION SHALL BE FIRE STOPPED.



BASEMENT NEW WORK PLAN  
1/8" = 1'-0" 1

ADDENDUM #02  
August 15, 2019

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1	08/15/19	ADDENDUM #02
NO.	DATE	REVISION

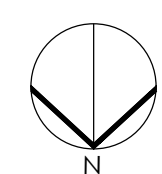
SCHOOL & LOCATION  
**CAMELOT ACADEMY**  
1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**BASEMENT NEW WORK PLAN**

DRAWING SCALE	
AS NOTED	
LOCATION NO.	FILE NO.
2310	
DRAWN BY	CHECKED BY
AD	NVP
8-036C	OF 2018 / 19
	OF

DRAWING NO.  
**E - 100.0**  
SHEET 4 OF 7



SEAL:

NAYAN VRIJIBHAI PATEL, PE  
PHILADELPHIA LICENSE NO. PE 088847

MEP Engineer

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**ADDENDUM #02**  
**August 15, 2019**

NO.	DATE	REVISION
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1	08/15/19	ADDENDUM #02

SCHOOL & LOCATION  
**CAMELOT ACADEMY**  
1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**FIRST FLOOR NEW WORK PLAN**

DRAWING SCALE AS NOTED	
LOCATION NO. 2310	FILE NO.
DRAWN BY AD	CHECKED BY NVP
8-036C	OF 2018 / 19
	OF

DRAWING NO.  
**E - 101.0**  
SHEET 5 OF 7

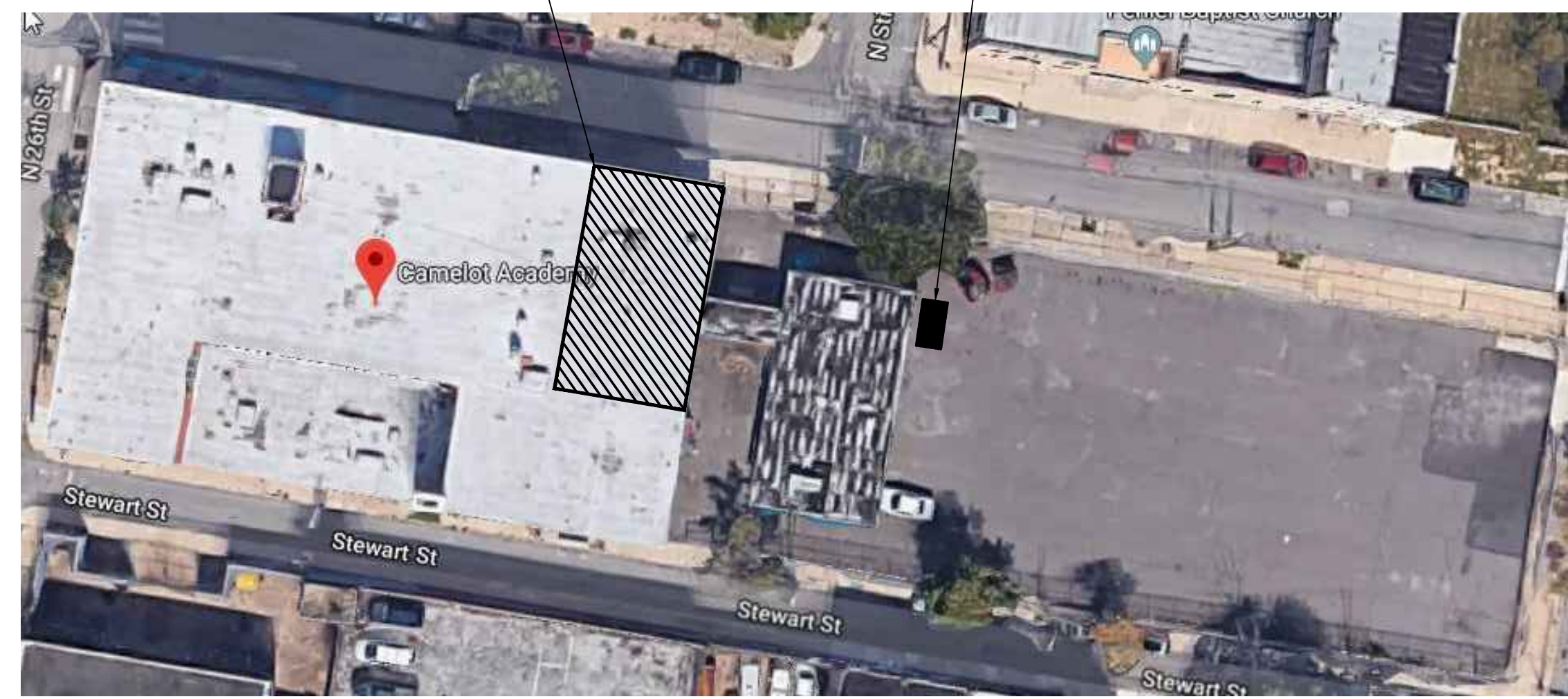
**GENERAL NOTES:**

- A. ALL CONDUIT SHALL BE THREADED GALVANIZED RIGID METAL (STEEL) CONDUIT ONLY.
- B. CONTRACTORS SHALL COORDINATE INSTALLATION WITH SDP ENVIRONMENTAL TEAM.

**NEW WORK KEY NOTES**

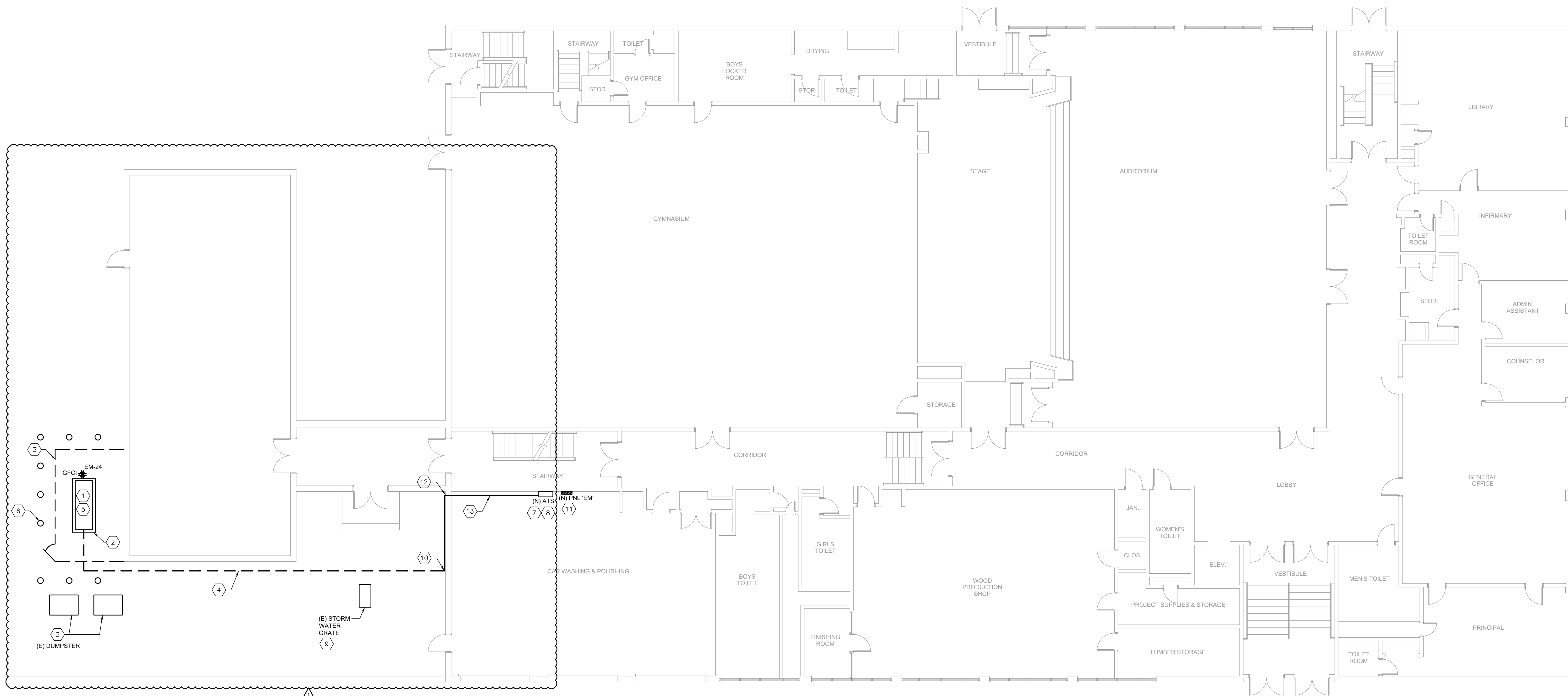
1. PROVIDE NEW DIESEL GENERATOR WITH LEVEL 1 SOUND ATTENUATING WEATHERPROOF ENCLOSURE. GENERATOR SHALL BE RATED FOR 15KW, 120/240V, 1PH, WITH 80A/2P MCB AT GENERATOR CONTROL PANEL. PROVIDE GENERATOR WITH 48-HOUR DOUBLE-WALLED 3KD-BASED DIESEL FUEL TANK WITH OVERFLOW AND SECONDARY VENTILATION MOUNTED UNDER GENERATOR. GENERATOR SHALL BE FUELED TO 100% AT STARTUP.
2. PROVIDE NEW 6" CONCRETE HOUSEKEEPING PAD, 3000 PSI CONCRETE SLAB FOR NEW GENERATOR. PAD SHALL EXTEND AT MINIMUM 6" BEYOND FOOTPRINT OF GENERATOR ENCLOSURE ON ALL SIDES. COORDINATE EXACT DIMENSIONS OF PAD WITH SELECTED GENERATOR EQUIPMENT. SEE DWG E501 FOR GENERATOR PAD DETAIL.
3. PROVIDE CHAIN LINK FENCE ON ALL THREE SIDES OF THE GENERATOR. SEE DWG E501 FOR FENCING DETAILS. COORDINATE RELOCATION OF DUMPSTER WITH SDP.
4. PROVIDE (1) 2" CONDUIT FOR GENSET INCOMING POWER WIRING, (1) 1" CONDUIT FOR CONTROL WIRING TO ATS, (1) 1" FOR GENERATOR EM, STOP AND REMOTE ANNUNCIATOR PANEL, (1) 1/2" FOR GENSET ACCESSORIES BRANCH CIRCUITS. CONDUITS SHALL BE ROUTED UNDERGROUND OUTSIDE BUILDING. CONDUITS SHALL BE ROUTED WITHIN CONCRETE ENCASED DUCTBANK ROUTED MIN. 30 INCHES BELOW GRADE. PATCH AND REPAIR ASPHALT SURFACE. SEE DUCTBANK DETAIL ON E501. CONTRACTOR SHALL GET APPROVAL FROM SCHOOL DISTRICT OF PHILADELPHIA CONSTRUCTION MANAGER PRIOR TO ROUTING CONDUITS. SEE DWG E501 FOR DETAIL OF CONDUIT PENETRATION OF EXTERIOR WALL.
5. PROVIDE POWER FOR GENERATOR ACCESSORIES: ANTI-CONDENSATE HEATER, BLOCK HEATER, CONVENIENCE RECEPTACLE, AND BATTERY CHARGER. UTILIZE DEDICATED 120V, 20AMP CIRCUITS FOR EACH ACCESSORY: ANTI-CONDENSATE HEATER - EM25, BLOCK HEATER - EM26, BATTERY CHARGER - EM23, CONV. RECEPTACLE - EM24. PROVIDE (2) #12 - (1) #12 GND FOR EACH CIRCUIT ROUTED WITHIN 1/2" CONDUIT TO GENERATOR. BREAKERS UTILIZED FOR GENERATOR ACCESSORIES SHALL BE LOCKED IN THE NORMAL/EMERGENCY SWITCH POSITION.
6. PROVIDE BOLLARD AROUND FENCE FOR PROTECTION AGAINST VEHICULAR TRAFFIC. SEE DWG E501 FOR BOLLARD DETAIL.
7. PROVIDE NEW 100A, 2 POLE, 240V, 3-WIRE ATS, ASCO 300 SERIES OR APPROVED EQUAL. ATS CONTROLLER SHALL BE PROVIDED WITH AUTOMATIC ENGINE EXERCISER FUNCTION. PROVIDE NEW NORMAL POWER FEEDER FROM EXISTING DISCONNECT SWITCH TO NEW ATS.
8. GENERATOR IS NOT A SEPARATELY DERIVED SYSTEM. GROUNDED NEUTRAL CONDUCTOR SHALL BE SOLIDLY INTERCONNECTED TO SUPPLY FEEDER CONDUCTORS NEUTRAL AT AUTOMATIC TRANSFER SWITCH. NEUTRAL CONDUCTOR SHALL NOT BE SWITCHED.
9. EXISTING STORM WATER GRATE. CONTRACTOR SHALL FIELD COORDINATE THE LOCATION OF DUCTBANK WITH THE EXACT LOCATION OF STORM WATER GRATE. CONTRACTOR SHALL ROUTE DUCT BANK TO AVOID THE EXISTING STORM WATER GRATE.
10. ROUTE CONDUITS FROM DUCT BANK UP EXTERIOR WALL AND ALONG WALL AT 10'-0" ABOVE GROUND. CONTRACTOR SHALL GET APPROVAL FROM SCHOOL DISTRICT OF PHILADELPHIA CONSTRUCTION MANAGER PRIOR TO ROUTING CONDUITS.
11. PROVIDE NEW 100A, 2 POLE, 240V, 3-WIRE ATS, ASCO 300 SERIES OR APPROVED EQUAL. ATS CONTROLLER SHALL BE PROVIDED WITH AUTOMATIC ENGINE EXERCISER FUNCTION. RECONNECT EXISTING NORMAL POWER FEEDER TO NEW ATS.
12. ROUTE CONDUIT THROUGH EXTERIOR WALL. CONTRACTOR SHALL FIELD COORDINATE EXACT LOCATION OF PENETRATION THROUGH WALL. PROVIDE CONDUIT LINK SEALS AT WALL PENETRATION. SEE DWG E501 FOR DETAIL OF CONDUIT PENETRATION AT EXTERIOR WALL. CONTRACTOR SHALL GET APPROVAL FROM SCHOOL DISTRICT OF PHILADELPHIA CONSTRUCTION MANAGER PRIOR TO ROUTING CONDUITS.
13. ROUTE CONDUIT ALONG INTERIOR WALL AND TERMINATE AT ATS AND PANELBOARD. CONTRACTOR SHALL GET APPROVAL FROM SCHOOL DISTRICT OF PHILADELPHIA CONSTRUCTION MANAGER PRIOR TO ROUTING CONDUITS.

AREA OF WORK  
LOCATION OF NEW GENERATOR



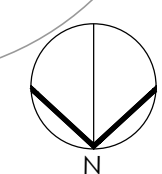
**PROJECT SITE PLAN**  
NOT TO SCALE

2



**FIRST FLOOR NEW WORK PLAN**  
1/8" = 1'-0"

1



SEAL:

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ADDENDUM #02  
August 15, 2019

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1	08/15/19	ADDENDUM #02

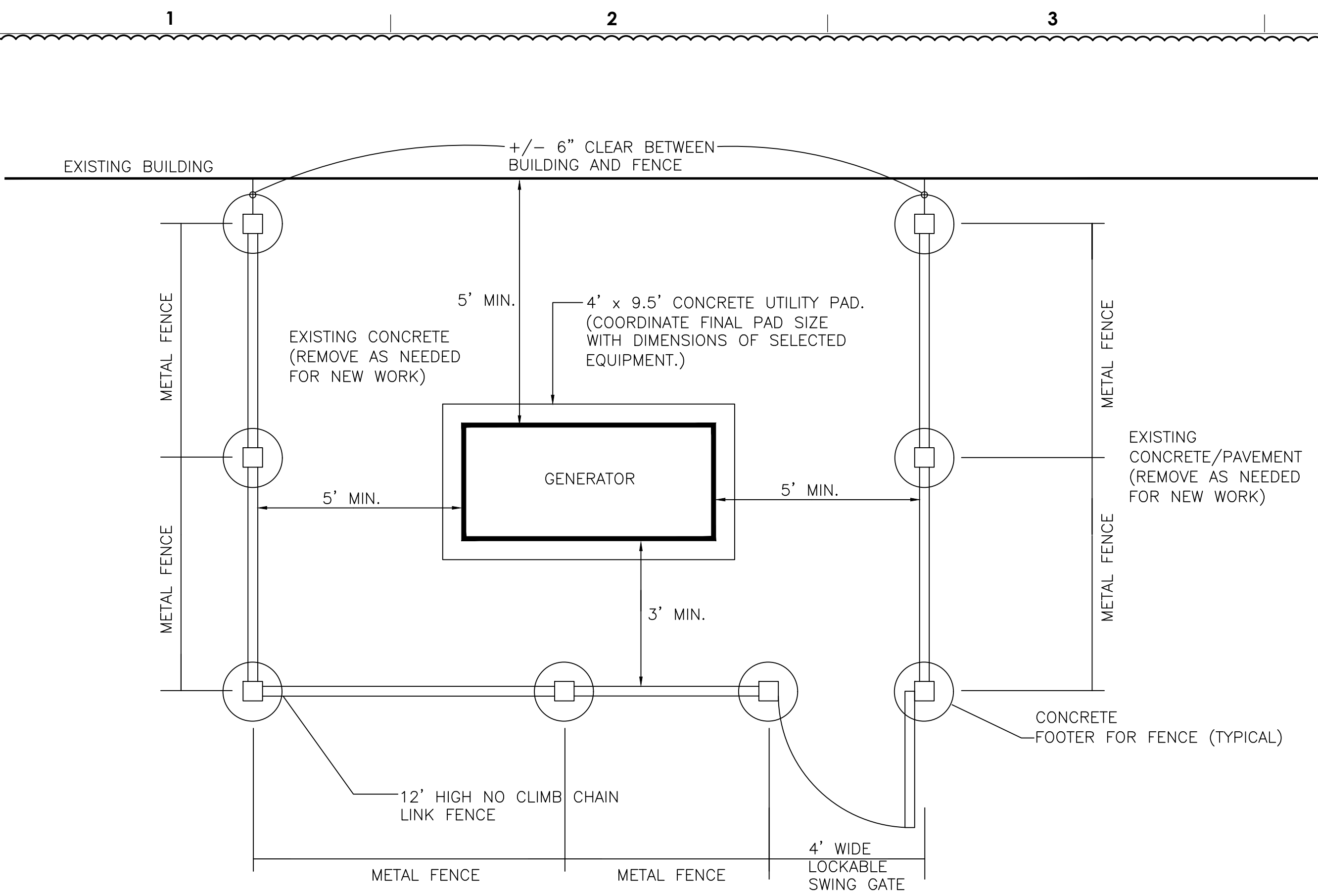
SCHOOL & LOCATION  
**CAMELOT ACADEMY**  
1435 N. 26TH STREET  
PHILADELPHIA, PA 19121

PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**DETAILS**

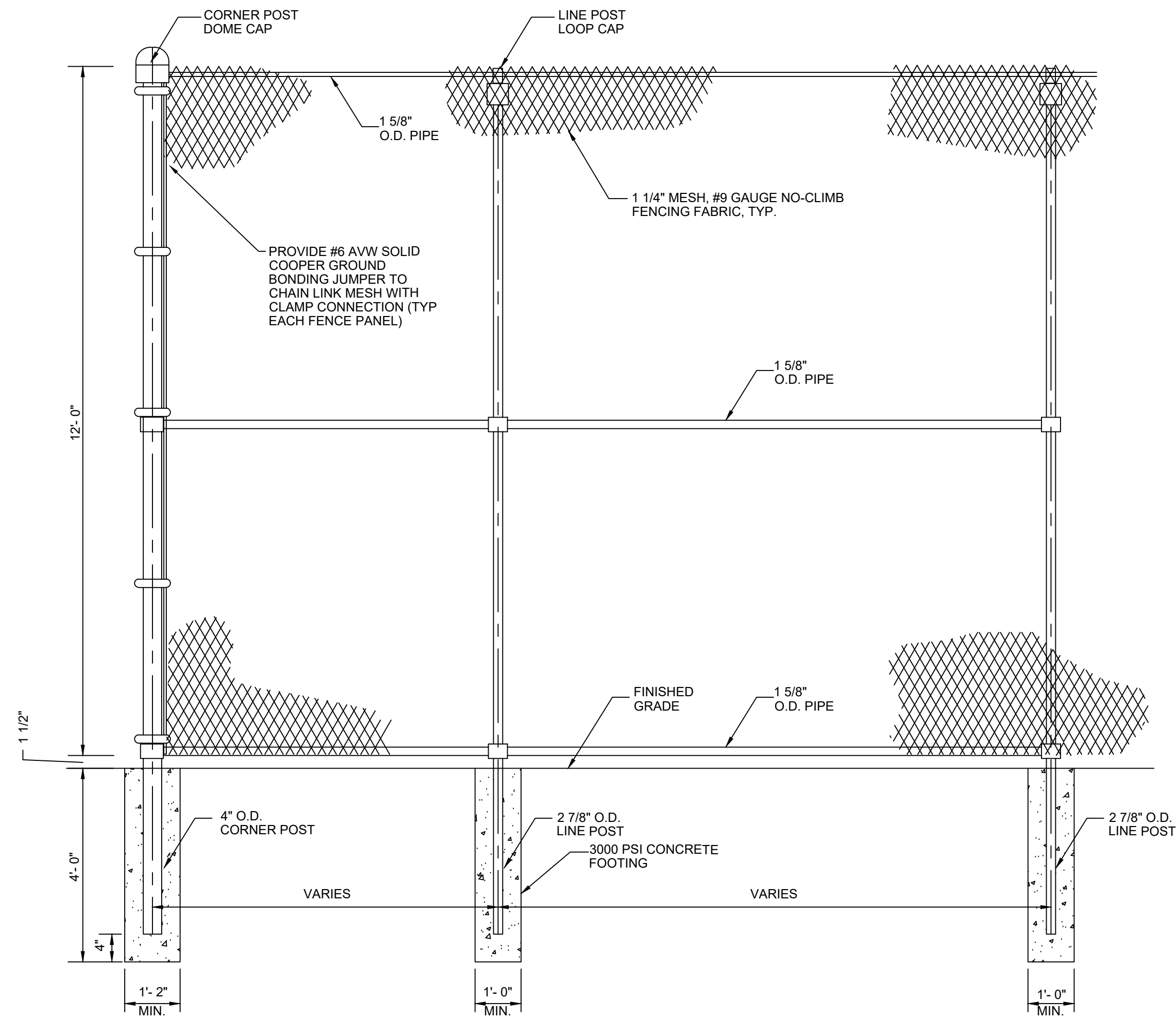
DRAWING SCALE AS NOTED	
LOCATION NO. 2310	FILE NO.
DRAWN BY AD	CHECKED BY NVP
8-036C	OF 2018 / 19 OF

DRAWING NO.  
**E-501.0**  
SHEET 6 OF 7

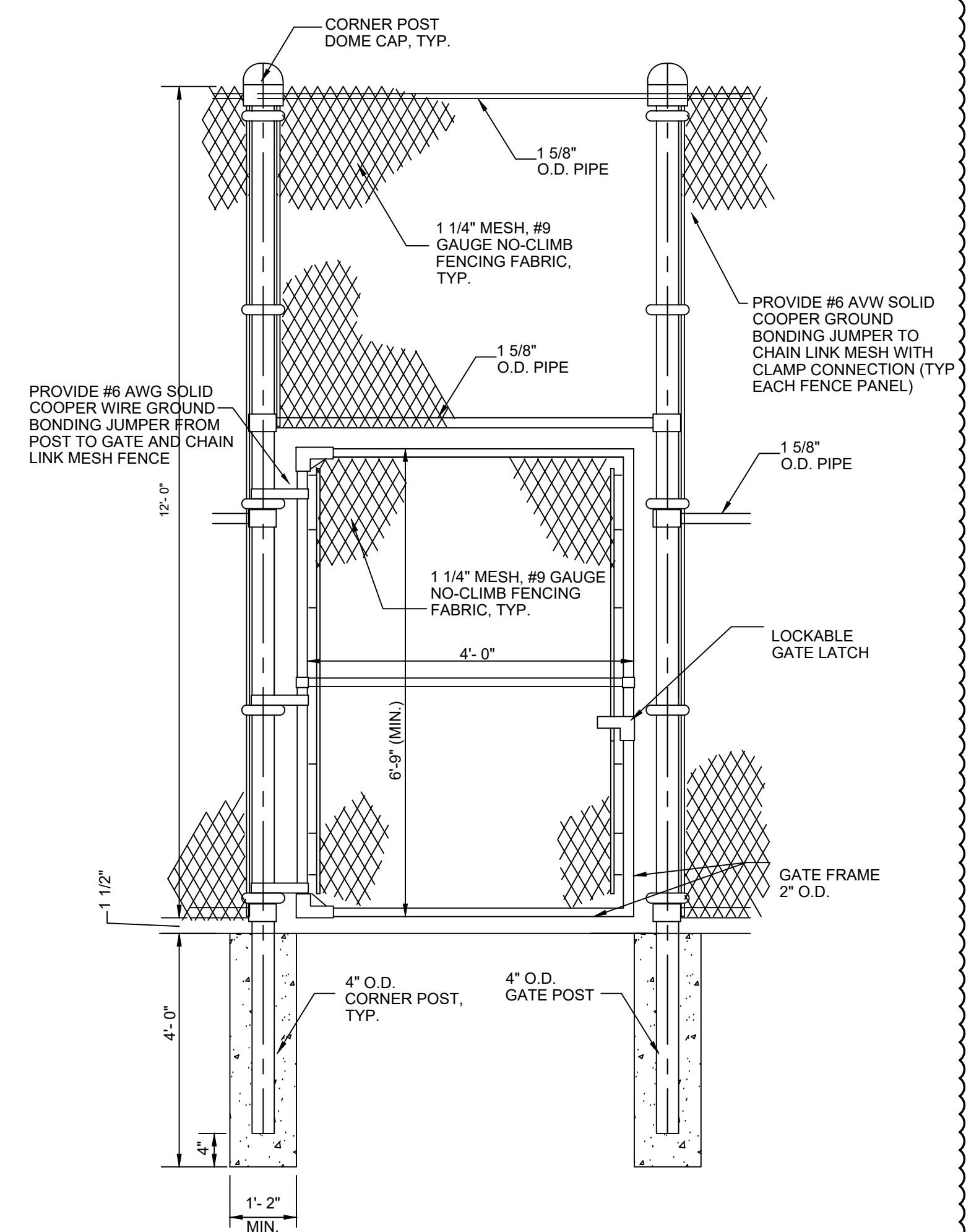


NOTES:  
1. ALL DIMENSIONS TO BE VERIFIED WITH FIELD CONDITIONS.  
2. METAL FENCE POST SHALL BE GROUNDED. SEE GROUNDING DETAIL.

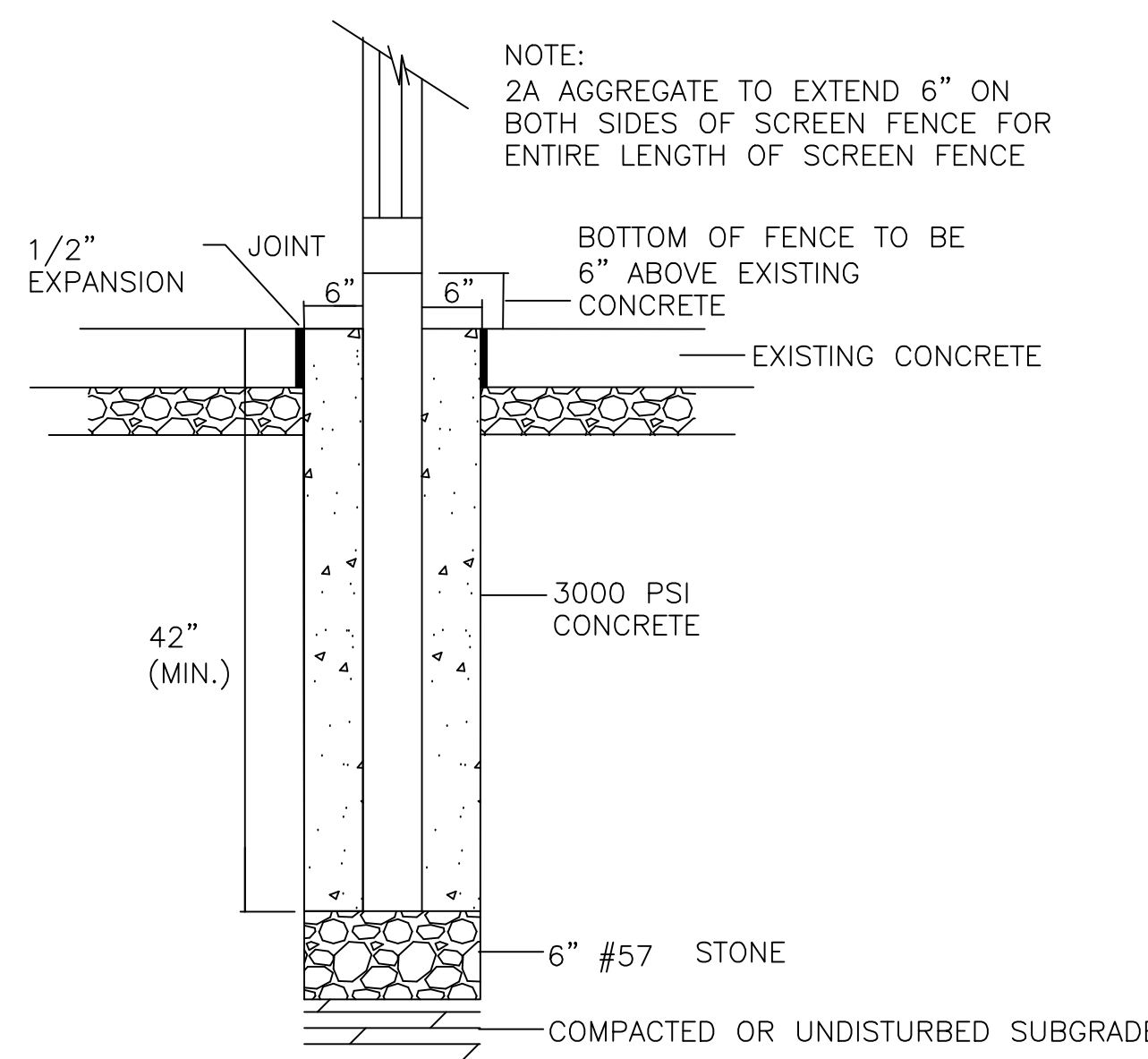
GENERATOR FENCE PLAN 1  
NOT TO SCALE



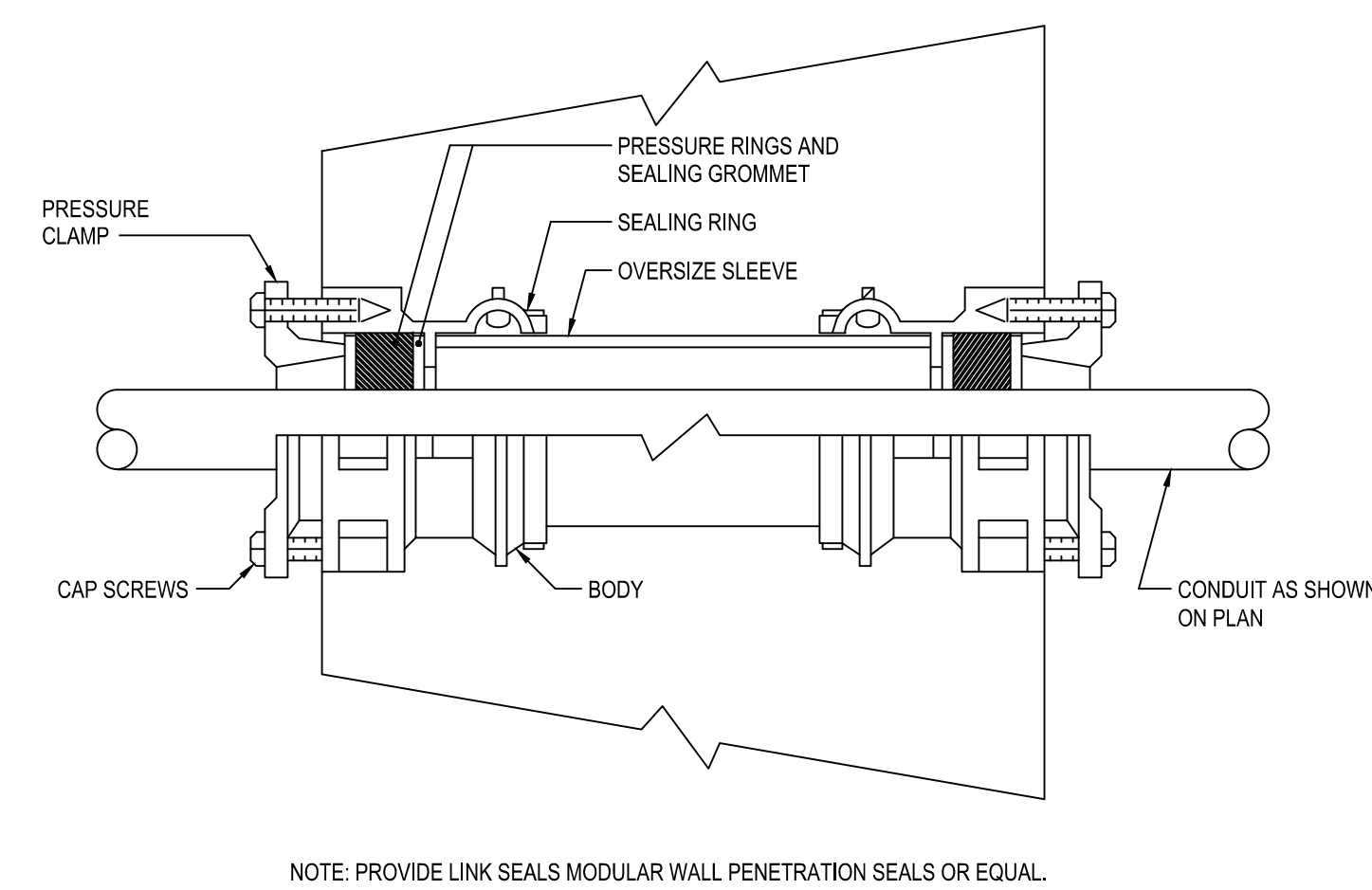
CHAIN LINK FENCE DETAIL 2  
NOT TO SCALE



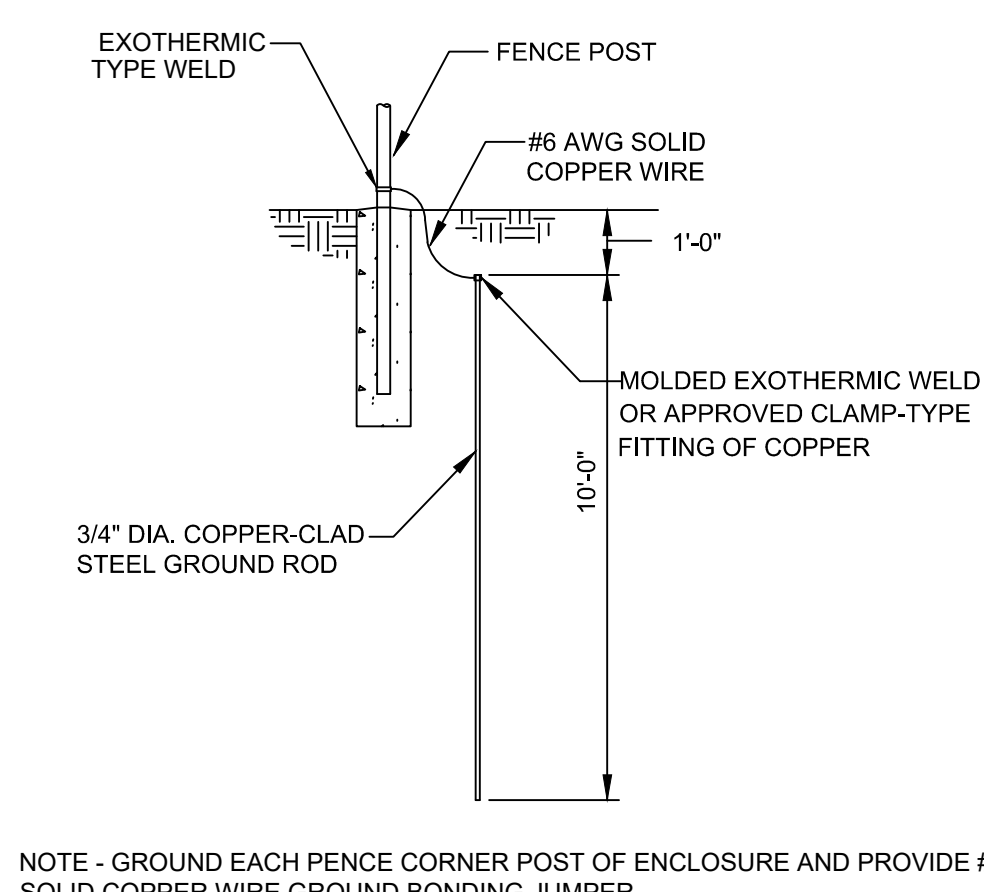
CHAIN LINK FENCE GATE DETAIL 3  
NOT TO SCALE



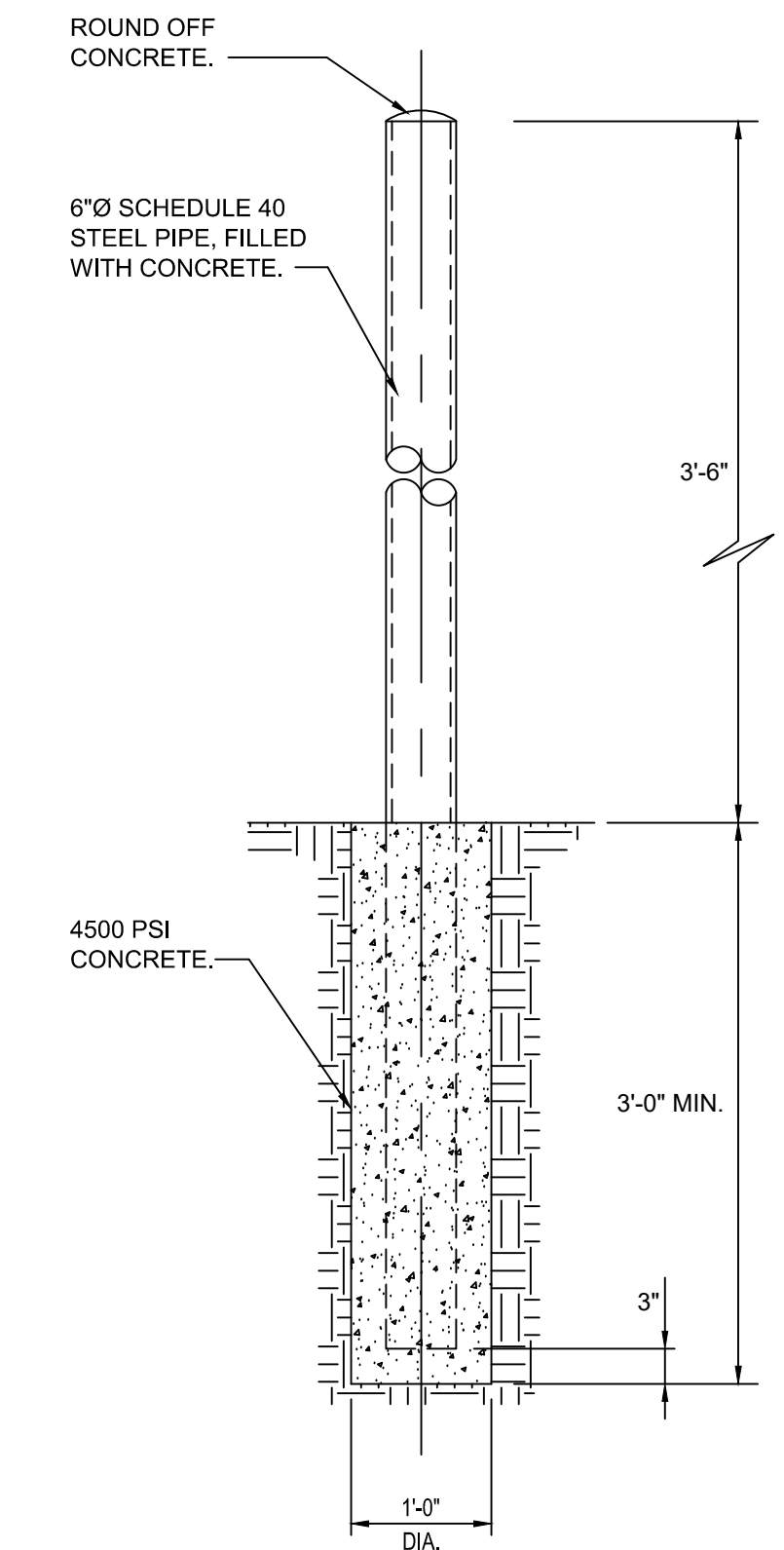
SCREEN FENCE POST FOOTER DETAIL 4  
NOT TO SCALE



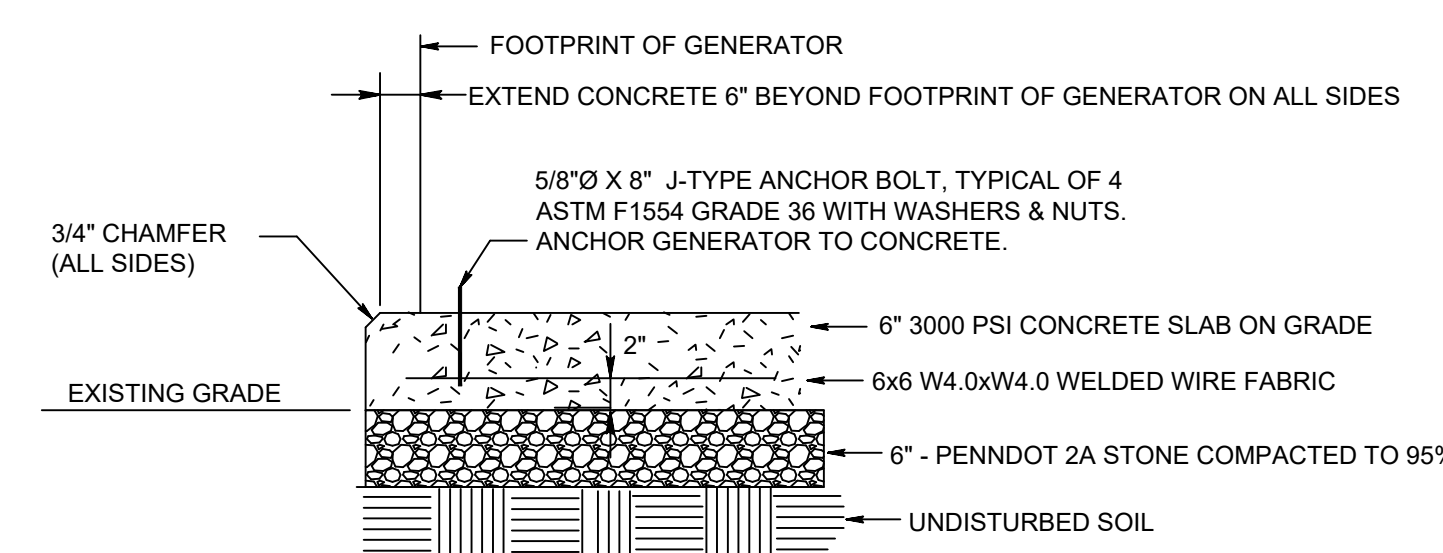
EXTERIOR WALL CONDUIT PENETRATION DETAIL 5  
NOT TO SCALE



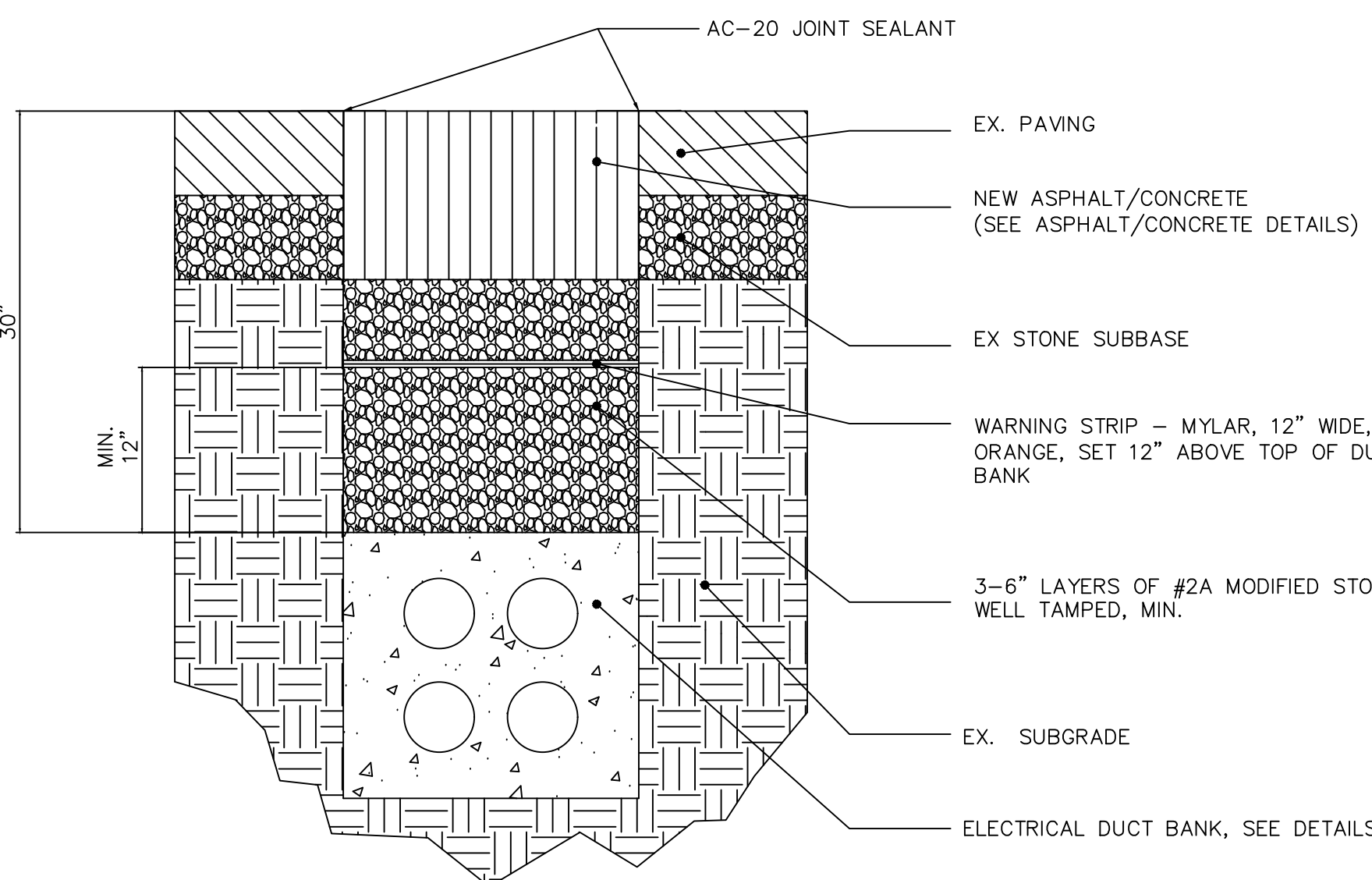
FENCE GROUNDING DETAIL 6  
NOT TO SCALE



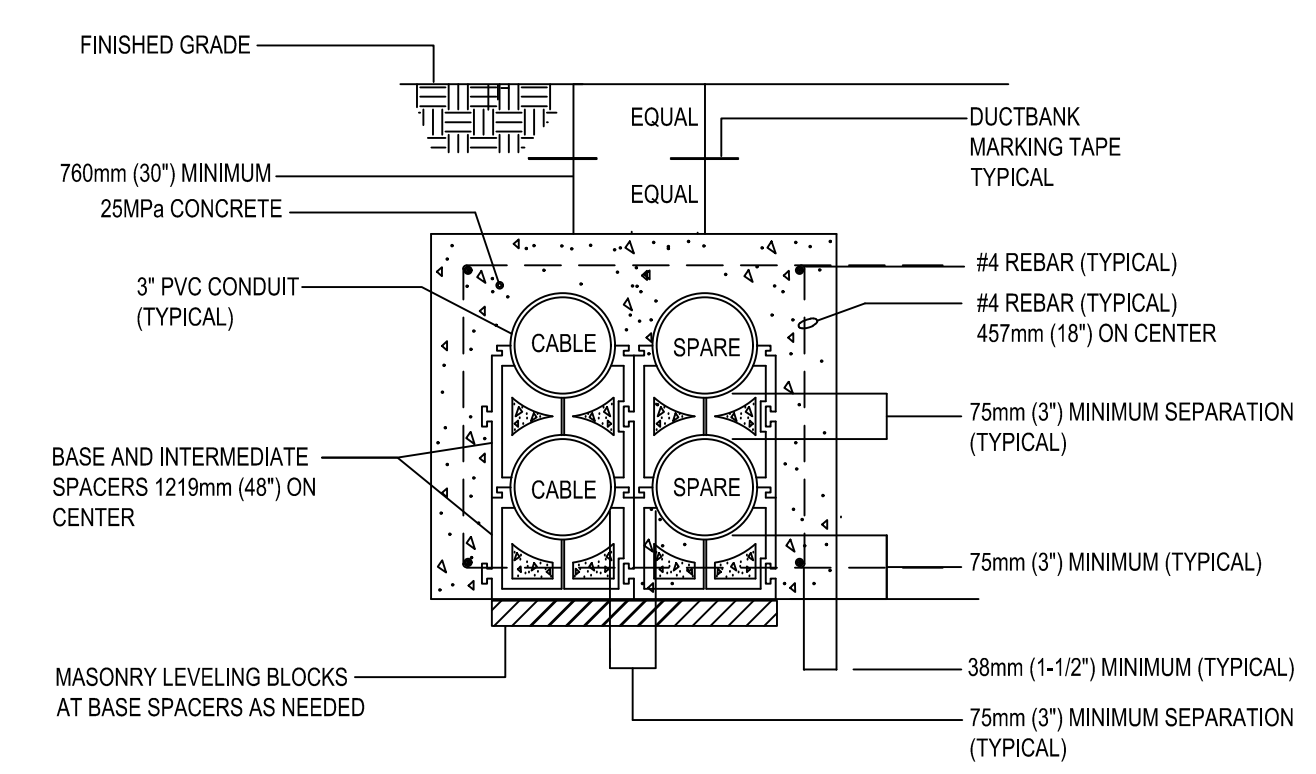
TYPICAL BOLLARD DETAIL 7  
NOT TO SCALE



GENERATOR HOUSEKEEPING PAD DETAIL 8  
NOT TO SCALE



ELECTRICAL DUCT BANK INSTALLATION UNDER CONCRETE OR ASPHALT DETAIL 9  
NOT TO SCALE



NOTES:  
1. GEOTECH TEST, IN ACCORD WITH ASTM D698. THE BOTTOM OF EXCAVATION TO ACHIEVE 8% TO 9% OF MAXIMUM DRY DENSITY, PRIOR TO CONCRETE PLACEMENT.

ELECTRICAL CONDUIT DUCTBANK DETAIL 10  
NOT TO SCALE



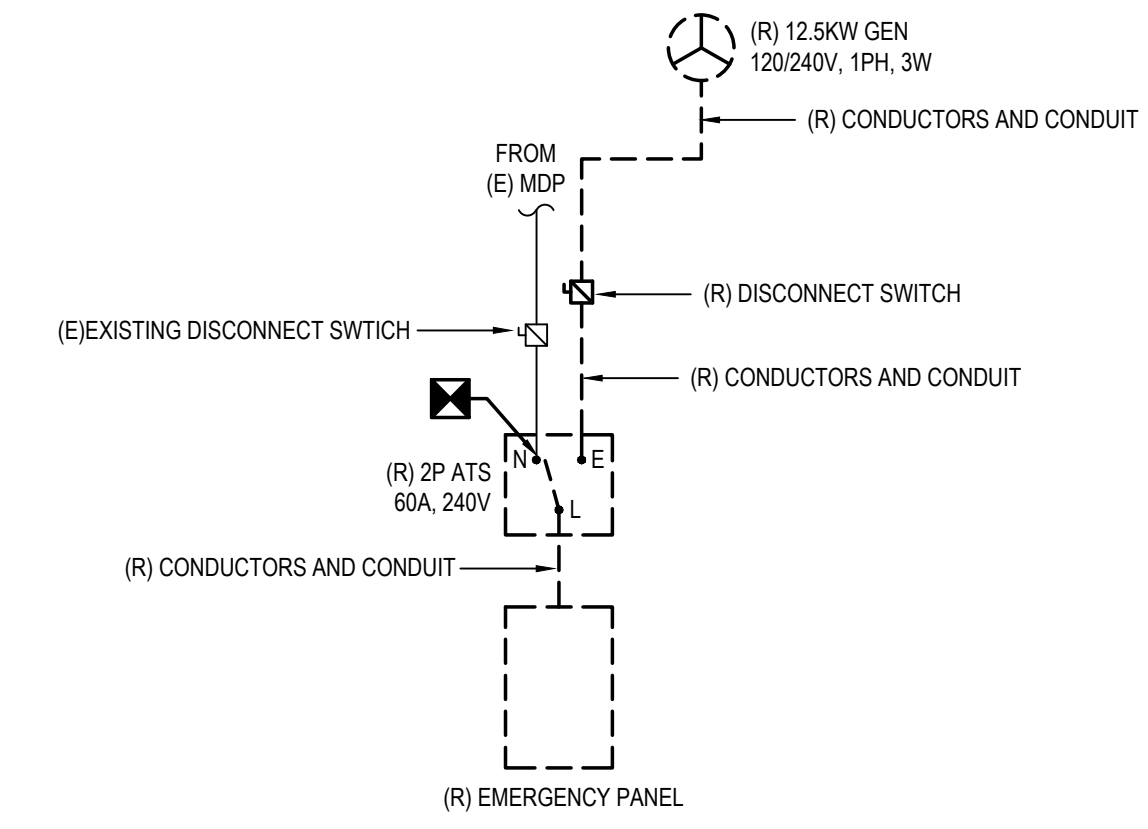
SEAL:

HAYAN V. RIBHAI PATEL, PE  
PENNSYLVANIA LICENSE NO. PE 088847

MEP Engineer

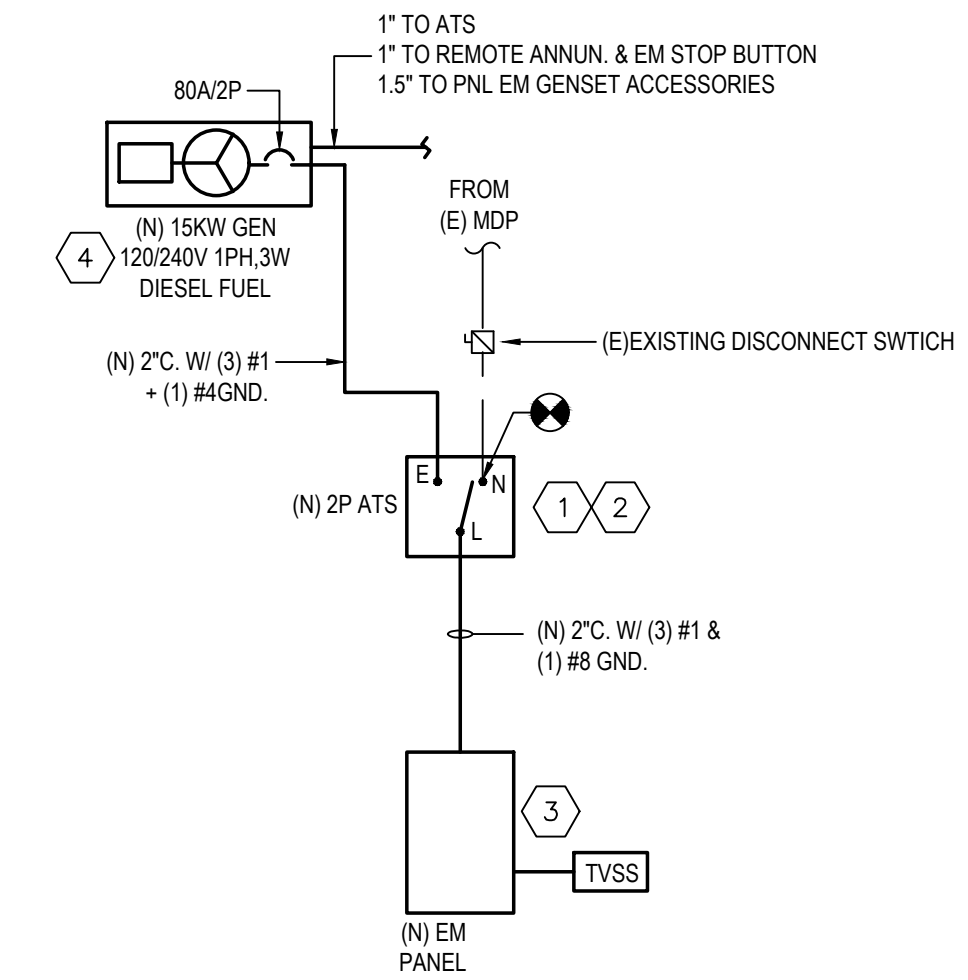
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DEMOLITION SINGLE LINE DIAGRAM 3  
NOT TO SCALE

- NEW WORK KEY NOTES**
1. PROVIDE NEW 100A, 2 POLE, 240V, 3-WIRE ATS, ASCO 300 SERIES OR APPROVED EQUAL. ATS CONTROLLER SHALL BE PROVIDED WITH AUTOMATIC ENGINE EXERCISER FUNCTION. RECONNECT EXISTING NORMAL POWER FEEDER TO NEW ATS.
  2. GENERATOR IS NOT A SEPARATELY DERIVED SYSTEM. GROUNDED NEUTRAL CONDUCTOR SHALL BE SOLIDLY INTERCONNECTED TO SUPPLY FEEDER CONDUCTORS NEUTRAL AT AUTOMATIC TRANSFER SWITCH. NEUTRAL CONDUCTOR SHALL NOT BE SWITCHED.
  3. PROVIDE NEW PANEL "EM". SEE SINGLE LINE DIAGRAM AND DWG E601 FOR MORE DETAILS. RECONNECT ALL EXISTING (QTY 20) BRANCH CIRCUITS TO NEW PANEL BOARD. PROVIDE NAME PLATE PLACARDS FOR EACH BRANCH CIRCUIT. PANEL BOARD SHALL BE PROVIDED WITH (1) MCB FOR NORMAL EMERGENCY FEEDER TO PANEL BOARD. PROVIDE PLACARD LABELS FOR MAIN BREAKER. PROVIDE A TVSS FOR NEW PANEL BOARD.
  4. CONTRACTOR IS RESPONSIBLE FOR FUELING OF GENERATOR TO 100%, START-UP, TESTING, COMMISSION, AND ALL MANUFACTURERS WARRANTY REQUIREMENTS.



NOTE - ALL CONDUIT SHALL BE THREADED GALVANIZED RIGID METAL (STEEL) CONDUIT ONLY.

NEW WORK SINGLE LINE DIAGRAM 4  
NOT TO SCALE

PANEL: EM (NEW)		VOLTAGE: 120/240V 1 PHASE 3 WIRE		BUS: 100A AMPS 10000 AIC				
LOCATION:		MOUNTING SURFACE: FLUSH		LUGS ONLY				
FED FROM:		DENOTES ARC FAULT INTERRUPTER C.B.		MCB 80A AMPS				
		DENOTES GFI C.B. RESID		COPPER BUS ONLY				
CIR #	EQUIPMENT SERVED	FEEDER SIZE Wire GND I.G.	Breaker Amps Poles	LOAD KVA L1 L2	Breaker Amps Poles	FEEDER SIZE Wire GND I.G.	EQUIPMENT SERVED	CIR #
1	(E) EXIT LIGHTS	12 12 - 20 1	1.0	A 1.0	20 1	12 12 -	(E) EXIT LIGHTS	2
3	(E) EXTERIOR LIGHTS	12 12 - 20 1	1.0	B 1.0	20 1	12 12 -	(E) EXTERIOR LIGHTS	4
5	(E) LIBRARY LIGHTS	12 12 - 20 1	1.0	A 1.0	20 1	12 12 -	(E) LIBRARY LIGHTS	6
7	(E) BOILER RM LIGHTS	12 12 - 20 1	1.0	B 1.0	20 1	12 12 -	(E) BOILER RM LIGHTS	8
9	(E) ELECTRICAL RM LIGHTS	12 12 - 20 1	1.0	A 1.0	20 1	12 12 -	(E) SPARE	10
11	(E) SPARE	12 12 - 20 1	1.0	B 1.0	20 1	12 12 -	(E) STAIR #1 LIGHTS	12
13	(E) ALLOTORIAN LIGHTS	12 12 - 20 1	1.0	A 1.0	20 1	12 12 -	(E) STAIR #2 LIGHTS	14
15	(E) GYMNASIUM LIGHTS	12 12 - 20 1	1.0	B 1.0	20 1	12 12 -	(E) STAIR #3 LIGHTS	16
17	(E) CAFETERIA LIGHTS	10 10 - 30 2	1.0	A 1.0	20 1	12 12 -	(E) SPARE	18
19	EXISTING LOAD	- - - 20 -	1.0	B 1.0	20 1	12 12 -	(E) SPARE	20
21	(E) SPARE	- - - 20 -	1.0	A 1.0	20 1	12 12 -	(E) SPARE	22
23	(N) BATTERY CHARGER	12 12 - 20 1	1.5	B 1.5	20 1	12 12 -	(N) CONV. RECEPT.	24
25	(N) AMP/CONDENSATE HTR	12 12 - 30 1	1.5	A 1.5	20 1	12 12 -	(N) BLOCK HEATER	26
27	(E) SPARE	- - - 20 -	1.0	B 1.0	20 1	12 12 -	(E) SPARE	28
29	(N) TVSS	10 10 - 30 2	2	A 30	20 1	- 12 -	SPARE	30
31	SPARE	- - - 20 1		B	20 1	- 12 -	SPARE	32
33	SPARE	- - - 20 1		A	20 1	- 12 -	SPARE	34
35	SPARE	- - - 20 1		B	20 1	- 12 -	SPARE	36
37	SPARE	- - - 20 1		A	20 1	- 12 -	SPARE	38
39	SPARE	- - - 20 1		B	20 1	- 12 -	SPARE	40
41	SPARE	- - - 20 1		A	20 1	- 12 -	SPARE	42
Remarks:		LINE TOTAL		8.5 8.5	4.5 5.5	PANEL SHALL BE EQUIPPED WITH BUSES FOR ALL		
		TOTAL CONN. KVA		23.0		GFS AND SPACES SHOWN		
		TOTAL CONN. AMPS		95.6		200% NEUTRAL BUS		
						ISOLATED GROUND BUS		
						GROUND BUS		

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PROJECT TITLE  
**GENERATOR REPLACEMENT**

DRAWING TITLE  
**SCHEDULES AND DIAGRAMS**

LOCATION NO.	FILE NO.
2310	
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8-036C	OF 2018 / 19
	OF

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**E - 601.0**  
SHEET 7 OF 7